e-ISSN: 2319-9865
p-ISSN: 2322-0104
Research and Reviews: Journal of Medical and Health Sciences

Thyroid Function Test Ordering Pattern in a Tertiary Care Hospital in Western Uttar Pradesh, India.

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Research Article

Received: 14/08/2013
Revised: 26/08/2013
Accepted: 17/09/2013

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Keywords: TSH, Thyroid Profile.

ABSTRACT

Disorders of the thyroid gland are amongst the most common endocrine disorders encountered in clinical practice. Thyroid function tests are used to evaluate the thyroid's functioning and to diagnose cause of thyroid diseases. The diagnosis of thyroid disease consists of a history and clinical examination, followed by specific confirmatory investigations. These investigations are an important diagnostic tool in thyroid disease. Also they are amongst the most common investigations ordered in clinical laboratories. These tests are relatively inexpensive individually but they account for a disproportionately large amount of health care expenditure for diagnostic testing. American thyroid association and American Association of Clinical Endocrinologists recommend serum TSH measurement as the single most reliable test to diagnose all common forms of hypothyroidism and hyperthyroidism particularly in the ambulatory setting. The aim of this study was to analyze the ordering pattern for thyroid function tests by physicians in Rama super speciality hospital. Total of 483 samples were received during study period of 1st January to 15th July 2013. Outpatients accounted for 86.7% of total samples with maximum requisitions from medicine followed by obstetrics and gynaecology. 46% of requisitions were for thyroid function test and approximately equal 46.7% for TSH only. While analysing the results it was seen that percentage of samples with normal results was around 77% in both thyroid profile and only TSH. Therefore we conclude that there is need for appropriate test ordering in a rational and cost effective manner and an optimal approach to identify patients of thyroid dysfunction.

INTRODUCTION

The burden of thyroid disease in the general population is enormous. Thyroid disorders are the most common among all the endocrine diseases in India [1]. Tests used to diagnose thyroid disorders are thyroid stimulating hormone (TSH) along with thyroid hormones, tri iodothyronine (T3) & tetra iodothyronine (T4) either in total or free form [2]. The guidelines of American thyroid association [3] and American Association of Clinical Endocrinologists [4] recommend serum TSH measurement as the single most reliable test to diagnose all common forms of hypothyroidism and hyperthyroidism especially in the ambulatory setting. Thyroid stimulating hormone confirms or excludes the diagnosis in all patients with primary hypothyroidism. Raised concentration of TSH is present in both overt and mild hypothyroidism [5]. Patients with hyperthyroidism have serum TSH concentration low usually less than 0.1 µIU/ml and sometimes even less than 0.05 µIU/ml. A serum TSH within the euthyroid reference interval almost always eliminates a diagnosis of hyperthyroidism [5]. Free T4 levels can be ordered when TSH level is abnormally high or low. This TSH centered strategy for initial evaluation of thyroid function is both cost effective and medically efficient [6]. The appropriate use of these tests remains controversial and medical practice generally varies from the guidelines. The studies done to evaluate the ordering pattern of thyroid function tests indicate that frequency of order of TFT is much higher than that of only TSH [7]. Similar studies have not been reported from northern part of India. There is a need to analyze the use of biochemical tests for diagnosis of thyroid disease so as to allow their rational and cost effective use and thereby more economical healthcare.

e-ISSN: 2319-9865
p-ISSN: 2322-0104

MATERIALS AND METHODS

This study was designed to analyze the ordering pattern of thyroid related tests referred by clinicians to the Immunoassay division of Biochemistry Lab of our 600 bed tertiary care teaching hospital in Western UP. This was a retrospective observational study. The samples referred to biochemistry lab from 1st Jan 2013 to 15th July 2013 for thyroid function tests were analyzed for the different combinations of tests ordered. Analysis of results was done to find out the percentage of abnormal reports. The criterions for abnormal reports were results higher or lower than the reference interval and thus included subclinical cases also.

Thyroid stimulating hormone (TSH), Total T3 (TT3), Total T4 (TT4), Free T4 (FT4) and Free T3 (FT3) were the assays performed in our lab. Estimation was done on automated immunoassay analyzer AIA 360 which works on the principle of fluoroimmunoassay. The reference ranges for variables were as follows:

Total T3 = 0.6–1.70 ng/ml, Total T4 = 4.0–11.0 µg/dl, FT3 = 2.0–4.9 pg/ml, FT4 = 0.75–1.54 ng/ml and TSH = 0.25–5.25 µIU/ml.

OBSERVATIONS AND RESULTS

During the study period starting from 1st Jan 2013 to 15th May, 2013, Immunoassay lab of biochemistry department of Rama Super speciality Hospital received 483 samples in which thyroid related tests were done. Table 1 and 2 show age and sex wise distribution of patients whose samples were received for thyroid related tests in our lab. It was seen that 381 (78.8 %) of these samples were of female patients and 102 (21.1%) were of the male patients.

Table 1: Sex wise Distribution of Patients

Male	Female
102 (21.1%)	381 (78.8%)

Table 2: Distribution of Patients according to age

Age (in Years)	1-10	11-20	21-30	31-40	41-50	51-60	60 onwards
Number	3 (0.6%)	36 (7.5%)	196 (40.6%)	143 (29.6%)	81 (16.8)	8 (1.6%)	16 (3.3%)

Mean Age =32.4 ± 4.1 years

Analysis of age wise distribution of samples was done to know about the susceptibility to thyroid disease among people of different age groups. There were 3 samples received from infants. These 3 samples were excluded for the calculation of mean age. Maximum samples were received from the patients in second and third decade of life i.e. 196 (40.6%) and 143 (29.6%) respectively followed by those in fourth decade 81 (16.8%) (Table II). Mean age of patients was 32.4 ± 4.1 years. Table III shows distribution of samples received from OPD and IPD. Table 4 shows the distribution of samples according to clinical department from which they were referred.

Table3: Inpatient and Outpatient Distribution of samples

OPD	IPD
419 (86.7%)	64(13.3%)

Data was analyzed for the distribution of samples from various clinical departments. Maximum number of samples was received from Medicine and Obstetrics & gynaecology (Obs & gynae) departments. 46.2% requests were received from the department of Medicine and 40.5 % from Obs & gynae (Table 4)

Distribution of ordering of TFT and TSH was studied for all samples received. Obs & Gynae ordered for 42.4 % & medicine for 43.3% of the total requests for estimation of TSH. 40.1% and 48.1%% of the requests for TFT estimation were received from Obs & gynae and medicine departments respectively. The samples from Obs & Gynae included five samples from pregnant females and three of these requests were made for the estimation of TSH. Table 5 shows the division according to the requisition for different thyroid related tests

Analysis of results was done after excluding the samples received from infants (Table VI). There were 3 such samples in total. Among the TFT profile samples, 79.2% had results within reference interval for all the three parameters and thus excluded thyroid disorder. 8.6% had high TSH with normal value for thyroid hormones which may be suggestive of subclinical hypothyroidism. Typical biochemical picture suggestive of hypothyroidism was observed in 3.2% of samples.

e-ISSN: 2319-9865
p-ISSN: 2322-0104

Table 4: Distribution of samples according to the clinical departments

Department	TFT Requisition	TSH Requisition	Others	Total No. (%)
Medicine	107	102	14	223 (46.2%)
Obs & Gynae	89	96	11	196 (40.5%)
Psychiatry	2	2	1	5 (1.0%)
ENT	3	2	2	7(1.4%)
Surgery	12	17	6	35 (7.2%)
Paeds	4	1	1	6 (1.2%)
Ortho	1	2	0	3 (0.6%)
Derma	2	3	0	5(1.0%)
Eye	2	1	0	3 (0.6%)
Total	222	226	35	483

Table 5: Analysis of different combinations of thyroid related tests ordered

Investigation ordered	Number of samples	Percentage (%)
T3/T4/TSH	222	46%
TSH	226	46.7%
FT3/FT4/TSH	12	2.5%
FT4 +TSH	5	1.1%
FT3+ FT4	6	1.2%
T3 +T4	3	0.6%
T4 + TSH	5	1%
Others	4	0.9%

Raised concentration of thyroid hormones with low TSH levels suggestive of hyperthyroidism was seen in 0.9 % of samples. T3 and T4 normal with TSH decreased was seen in 2.7 % of the samples .T4 toxicosis (T4 raised, T3 normal, TSH low) was seen in 1.4% of cases referred (Table 6). Another important category was of results which had T4 as the only abnormal parameter with other two lying within reference interval. 0.9% of the samples had this type of result. Analysis of results for TSH requests showed that the results of 77.4 % samples were within the reference interval. 15.9% of samples had TSH results higher and 6.7% had values lower than the reference range (Table7).

Table 6: Analysis of results for thyroid profile samples

Investigation ordered	Number	Percentage
T3/T4/TSH Normal (N)	176	79.2%
T3 & T4N, TSH ↑	19	8.6%
T3 & T4N, TSH↓	6	2.7%
T3 & T4↓ ,TSH↑	7	3.2%
T3 & T4↑ ,TSH↓	2	0.9%
T3N, T4↑ , TSH↓: (T4 toxicosis)	3	1.4%
T4↑, T3 & TSH N	2	0.9%
Others	7	3.1%

Table 7: Analysis of results of TSH samples

	TSH normal (0.25–5.25 µIU/ml)	TSH (5.25 µIU/ml)	TSH (0.2 µIU/ml)
TSH	175	36	15
Percentage	77.4%	15.9%	6.7%

DISCUSSION

In our study we found that there were more of female patients (78.8%) referred compared to males (21.1%) for thyroid related tests. This difference may attributed to the bias of clinician in suspecting thyroid disorder in female patients as these are common in females as compared to males [8]. Analysis of age wise distribution of samples showed maximum samples were received from the patients in second and third decade of life i.e. 196 (40.6%) and 143 (29.6%) respectively followed by those in fourth decade 81 (16.8%). Mean age of patients was 32.4 ± 4.1 years. High prevalence of thyroid disorders has been reported in age groups of 21–35 and 20–55

respectively in previous studies from India [9, 10] .The samples received had more of outpatients compared to inpatients. Ordering of few TFTs in inpatients is a good practice because as many as 3% of hospitalized patients on admission have subnormal TSH values often associated with the acute phase of illness known as the euthyroid sick syndrome. Assessment of thyroid function in ill patients should be postponed until the illness resolves, unless and until a diagnosis would affect patient outcome [5].

In our study maximum number of samples was received from Medicine (46.2%) and Obstetrics & gynaecology (Obs & Gynae) departments (40.2%). Obs & Gynae ordered for 42.4 % & medicine for 43.3% of the total requests for estimation of TSH. 40.1% and 48.1%% of the requests for TFT estimation were received from Obs & gynae and medicine departments respectively. On data analysis it was seen that 46% of total samples were ordered for complete thyroid profile (T3, T4 & TSH) and Thyroid stimulating hormone was the investigation requested in 46.7% of samples. Among the TFT profile samples, 79.2% had results within reference interval for all the three parameters and thus excluded thyroid disorder. 8.6% had results which are suggestive of subclinical hypothyroidism. The worldwide prevalence of subclinical hypothyroidism ranges from 1 to 10% [11, 12]. These patients can progress to overt hypothyroidism at the rate of 5% per year, it is important to identify these patients [13, 14]. Typical biochemical picture suggestive of hypothyroidism was observed in 3.2% of samples.

Findings suggestive of hyperthyroidism were seen in 0.9 % of samples. T3 and T4 normal with TSH decreased was seen in 2.7 % of the samples .T4 toxicosis (T4 raised, T3 normal, TSH low) was seen in 1.4% of cases referred. A category was of results which had T4 as the only abnormal parameter with other two lying within reference interval. 0.9% of the samples had this type of result. This may be due to rise in levels of thyroxin binding globulin which may occur due to pregnancy, neonatal age, infection, chronic active hepatitis, genetic factors and use of drugs e.g. estrogen, oral contraceptive pills and tamoxifen [15] .

Analysis of results for TSH requests showed that the results of 77.4 % samples were within the reference interval. 15.9% of samples had TSH results higher and 6.7% had values lower than the reference range. Since the percentage of samples with normal results was around 77% in both thyroid profile and only TSH samples, it can be concluded that estimation of thyroid hormones does not offer any additional information in majority of patients. Percentage of normal results did not have much difference when results for all the TSH tests done during this period were taken into account (only TSH / TSH included in thyroid profile or in other combinations).

CONCLUSION

So, we conclude from our study that in spite of well-known guidelines favouring TSH as the screening test for thyroid dysfunction, clinicians are still requesting thyroid profile in Indian scenario. This indicates a need to evolve a standard case definition with the involvement of clinical departments to rationalise the testing behaviour of clinicians with regard to thyroid dysfunction. By improving the appropriateness of requisitions of tests related to thyroid function will definitely lead to more cost effectiveness and thereby help in achieving better patient satisfaction.

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e-ISSN: 2319-9865
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