

Rational use of thyroid function test

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Introduction:

Thyroid function test (TFT) is one of the frequently asked investigations. There is continuous increase and demand for this test. The reasons for increased number of thyroid testing include the wide list of clinical presentation of thyroid disorders with variable signs and symptoms. The thyroid gland itself can be affected with different ranges of disorders including auto-antibodies, congenital, genetics and cancers (1,2). In addition, the thyroid disorders can mimic or co-exist with other conditions especially in elderly and children. This climbing number of tests makes a financial burden to the laboratory. It necessitated extra reagents and consumables, extra manpower and some time extra analyzer.

Nizwa hospital laboratory is a referral laboratory covering an area with population of approximately 300 thousands (3). The most commonly performed thyroid function (TFT) tests used to establish if there is thyroid dysfunction or to monitor the respond to treatment include thyroid stimulating hormone (TSH), free thyroxine (FT4), free tri-iodothyronine (FT3) and anti-peroxidase antibodies (4).

In most laboratory, measurement of TSH has become the principal test for the evaluation of thyroid function in most circumstances. If TSH value within the reference interval, that excludes the majority of cases of primary overt thyroid disorders. However, If TSH is abnormal; confirm the diagnosis with free thyroxine (FT4). Where risk factors exist, consider free triiodothyronine (FT3).

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The thyroid disorders are increasing. The prevalence of one disorder like hypothyroidism reached 2%. More prevalence is subclinical hypothyroidism, which can be seen in as many as 15% of older women (5-7). Other leading cause for thyroid disorders include Chronic autoimmune (Hashimoto's) thyroiditis. It is estimated up to 15% of elderly women have thyroid autoantibodies. Individuals, who have detectable thyroid autoantibodies, are at increasing risk for developing overt hypothyroidism (6). Iodine deficiency or excess can affect thyroid gland. Large amounts of iodine found in radiographic contrast agents and in the drug amiodarone (8). Patients treated for thyroid disorders increasing with time and need ongoing monitored for thyroid function. Group of patients underwent external radiation of the head and neck or sometime whole body radiation . In these group a continuous monitored of their thyroid function is required . In these group of patients thyroid disorders might develop after several years after treatment (9-11).

Pregnant women are another group of patients demanding thyroid gland testing . pregnancy leads to an increase in thyroid size because of increase in formation of new thyroid nodules. One known complication is hyperthyroidism in molar pregnancy due to the excessive production of human chorionic gonadotropin (12-15).

Aims :

- 1- To determine the total number of TSH, FT4 and FT3 done over 5 years period.
- 2- To determine the total cost of these test over the same period
- 3- To compare the total number of test to the total population in the region.
- 4- To calculate the percentage of TFT with and without relevant clinical details.
- 5- To determined, how many of these tests give a normal result.

Methods:

In this study, a shifa information system is used to obtain the needed information. It is a health information program. It is the main software used in ministry of health. It used in all hospitals under the ministry of health. The cost used in this study is an estimate. In this study, ten Omani Rials (26.01 USD)used as the cost of each parameter. The total population in the region obtained from the national census. For each year, the first 100 TFTs reviewed to obtain the percentage of TFT with normal results and the same applied for the availability of the relevant clinical details as listed in medical textbooks. The parameters used in this study performed using Cobas e 411 chemical analyzer. Using Electro-chemiluminescence immunoassay (ECLIA) techniques.

Finding:

1- The total number of TSH , FT4 and FT3 during the five years :

Year	TSH	FT4	FT3	Total
2009	15248	7606	112	22966
2010	17574	9391	372	27337
2011	21389	12594	404	34387
2012	23446	13205	326	36977
2013	27281	15951	308	43540
			Total	165207

2- The total cost of TSH, FT4 and FT3:

Year	TSH	FT4	FT3	TOTAL
2009	152480	76060	1120	229660
2010	175740	93910	3720	273370
2011	213890	125940	4040	343870
2012	234460	132050	3260	369770
2013	272810	159510	3080	435400
			Total	1652070

3- The total number of test to that of population.

Year	TFT No.	Population	Test to population
2009	22966	332772	6%
2010	27337	326651	8.4%
2011	34387	342017	10%
2012	36977	368027	10%
2013	43540	387111	11%

4- Percentage of normal TFT to abnormal TFT

Year	Normal TFT%	Abnormal TFT%
2009	67	33
2010	61	39
2011	42	58
2012	49	51
2013	66	34

5- Percentage of TFT with and without clinical details:

Year	TFT % with clinical details	TFT% without Clinical Details
2009	26	74
2010	72	28
2011	84	16
2012	65	35
2013	41	59

Finding

TABLE 1:

There is an increased in the total number of tests from 2009 to 2010 by 16 %. There is an increased in the total number of tests over the five years period from 2009 to 2013 by almost 90% .

TABLE 2:

There is an increase in the total cost of the tests from 2009 to 20010 by 19 percent. There is an increase in the cost of the five years period from 2009 to 2013 by 90 percent.

TABLE 3:

There is an increase by 2.4% in the total test per population from 2009 to 2010. Overall, there is an increase by 5 percent in the total test per population from 2009 to 2013.

TABLE 4:

In 2009, the percentage of normal TFT results were 67 percent. In 2013 the percentage of normal TFT results were 66%.

TABLE 5:

Thyroid function test samples without relevant clinical details were 74% and in 2013 59 percent.

Discussion:

During the five years study period we have done more than 165 thousands thyroid tests. The cost was more than 1.6 million Omani Rials (. The covering rate for population was between 6%-11% test per population. The majority of the test done revealed normal results (40-66%). Tests without clinical details ranging from 16 – 74 percent.

During the study period, almost 1.6 Million of Omani Rials (4,155,844.80 USD) spent in thyroid function testing. It seems that 1.6 million is a lot of money spent in thyroid testing. This figure is going to increase if all the hospitals doing TFT are included in this study. The figure will be more than ten times this amount. TFT by no means is limited to TSH, FT4 and FT3. Histopathology and radiological examinations added on the cost. Screening for thyroid disorders is another trend add on to the cost. Screening programs like; newborn screening program, screening the pregnant women, screening elderly group and screening diabetic patients for thyroid disorders. Strictly applying these programs will end up virtually testing all the population. To use the limited resources wisely and effectively, there is an urge need for refined TFT guidelines. In this study TFT done in private hospitals and laboratories were not included.

Disclosure

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Reference:

- [1] Guber HA, Farag AF. Evaluation of endocrine function. In: McPherson RA, Pincus MR, eds. *Henry's Clinical Diagnosis and Management by Laboratory Methods*. 22nd ed. Philadelphia, PA: Elsevier Saunders; 2011:chap 24.
- [2] Salvatore D, Davies TF, Schlumberger MJ, et al. Thyroid physiology and diagnostic evaluation of patients with thyroid disorders. In: Melmed S, Polonsky KS, Larsen PR, Kronenberg HM, Larsen PR, et al, eds. *Williams Textbook of Endocrinology*. 12th ed. Philadelphia, PA: Elsevier Saunders; 2011:chap 11
- [3] Statistical year book 2014, National Center for Statistic and Information , Sultanate of Oman.
- [4] Todd CH; Management of thyroid disorders in primary care: challenges and controversies. *Postgrad Med J*. 2009 Dec;85(1010):655-9.
- [5] Hollowell JG, Staechling NW, Flanders WD, et al. Serum TSH, T(4). And thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES 111). *J Clin Endocrine Metab* 2002;87:489-99.
- [6] Tunbridge WM, Evered DC, Hall R, et al. The spectrum of thyroid disease in a community : the whickham survey. *Clin Endocrinol (Oxf)* 1977;7:481-93.

- [7] Lazarus JH, Silent thyroiditis and subacute thyroiditis. In Braverman LE, Utiger RD, editors. *The thyroid: a fundamental and clinical text*. 7th edition. Philadelphia: Lippincott Raven; 1996. P. 577-91.
- [8] Andersson M, Takkouche B, Egli I, et al. Current global iodine status and progress over the last decade towards the elimination of iodine deficiency . *Bull World Health Organ* 2005;83:518-25.
- [9] Hancock SL, Cox RS, McDougall IR. Thyroid diseases after treat of Hodgkin s disease. *N Engl J Med* 1999;325:599-605.
- [10] Mercado G, Adelstein DJ, Saxton JP, et al. Hypothyroidism :a frequent event after radio-therapy and after radiotherapy with chemotherapy for patients with head and neck carcinoma. *Cancer* 2001;92:2892-7.
- [11] Tell R, Sjodin H, Lundell G, et al. Hypothyroidism after external radiotherapy for head and neck cancer. *Int J Radiat Oncol Biol Phys* 1997;39:303-8.
- [12] Kung AWC, Chau MT, Lao TT, et al . The effect of pregnancy on thyroid nodule formation. *J Clin Endocrinol Metab* 2002; 97:1010-1014
- [13] Glinoe D, Soto MF, Bourdoux , et al. Pregnancy in patients with mild thyroid abnormalities: maternal and neonatal repercussions. *J Clin Endocrinol Metab* 1991 ; 73:421 – 427.
- [14] Kato K, Mostafa MH, Mann K, et al. The human chorionic gonadotropin molecule from patients with trophoblastic diseases has a high thyrotropic activity but is less active in the ovary. *Gynecol Endocrinol* 2004; 18: 259-277. This paper reported the investigation into the molecular variant of human chorionic gonadotropin that has a greater effect on the thyroid than on the ovary.
- [15] Pop VJ, Kuijpers JL, van Baar AL, et al. Low maternal free thyroxine concentrations during early pregnancy are associated with impaired psychomotor development in early infancy. *Clin Endocrinol* 1999; 50: 149 – 155.