

Thyroid Dysfunction: Hormone Assays; What ? & When ?

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Introduction

Thyroid function study is an important tool to investigate a suspected thyroid pathology, but one needs to remember that, thyroid function is affected by age, pregnancy, iodine consumption and many non thyroidal illnesses and also by many drugs. So the interpretation of thyroid hormone levels in the blood needs, that clinician be aware of all these facts. Let us consider some of these important factors

- **Thyroid Function In Newborn**

At delivery due to sudden exposure to cold, the TSH level start rising and within 30 minutes TSH levels as high as 100-150 mIU/ml are seen. These come back to normal within 48 hours of life. Total T₄ and Total T₃ levels increase within 24-36 hours of life, remain so for 10 -12 days and then start returning to normal. Total T₄ levels remain at high normal, but Total T₃ remains above for 6 – 8 years of life.

Cord blood shows high values of Total T₄ (due to high TBG), low T₃, high FT₃, high TSH. To avoid confusion in the diagnosis of congenital hypothyroidism one should order a thyroid function test in a new born between 5 – 12 days of life. A screening test should be only TSH assay, as, if it is more than 5.0 it is suspicious of and if more than 10mIU/ml is Diagnostic of congenital hypothyroidism, which can further be confirmed by assay of free T₄. Incidence of congenital hypothyroidism is about 1 in 36000 livebirths. 98% of these will be thyroprivic ones and only 2% will be trophoprivic which can be missed with routine TSH RIA, but will be picked up by 4th generation supersensitive TSH assays.

- **Effects of I² On Thyroid Function**

Unfortunately many patients are receiving I² orally before they are referred for thyroid function studies. This practice needs to be abandoned as the I² content of such preparations is 8000 mg / 5 ml (consider normal requirement of I² to be 100 – 150 micrograms / day). No wonder erratic and unexpected results are often seen.

High dose I² blocks the organification of thyroid hormones, and acutely depresses the release of T₄ from the gland, thus causing hypothyroidism. Many patients escape this effect by an adaptive / escape mechanism, but quite a few cannot and they develop hypothyroidism - iodine myxoedema. Iodine can precipitate toxicosis in patients with multinodular goiter. Iodine also decreases peripheral conversion of T₄ to T₃

- **Effects of Pregnancy On Thyroid Function**

Increased TBG in first trimester causes two fold increase in total T₄ and T₃ levels. There is slight increase in the free hormone level also. TSH is usually decreased. By about 13 -14 week of gestation, free thyroid hormone levels have returned to normal, but total T₄ and T₃ levels remain high throughout pregnancy.

Therefore it is simply logical to investigate thyroid function in pregnancy one should order free T₄ and supersensitive TSH assay.

- **Non-thyroidal Illness (NTI) and Thyroid Function**

In variety of ways NTI's alter thyroid hormone levels. The change in thyroid hormones produced but NTI's reflects the severity of NTI. Accordingly these can be classified as 1 - mild disease, 2 – disease of moderate severity, 3 – severe illness (patients in ICU).

- Mild NTI: e. g. Diabetes, Hypertension, Infection, Malnutrition etc. Here peripheral conversion of T_4 to T_3 is reduced, causing low T_3 syndrome. This lowering of T_3 is nonspecific and its significance is just like a raised ESR only.
- Moderate NTI: e.g. Pneumonia, Septicemia, CRF, Malabsorption etc. Here both T_4 and T_3 are lowered, but TSH is normal (thus distinguishing a primary hypothyroidism with NTI). Free hormones are however normal.
- Severe Illness (ICU patient): There is marked lowering of total T_4 and T_3 TSH is also low / suppressed. This is a common finding if patient is on dopamine drip. During recovery TSH levels start rising.

There are some diseases (e.g. Hepatic cirrhosis, active hepatitis, Hyperemesis gravidarum) where total T_4 levels are high, but free T_4 is normal.

Gross mistakes in interpretation of TFTs can occur if one is not aware of NTI patient is suffering from and its severity. Ordering a free T_4 and a supersensitive TSH assay is of great value in these patients esp. in patients in ICU.

a. Drugs Affecting Thyroid Function:

Many Drugs Affect Thyroid Function Tests:

DRUG	TOTAL T_4	FREE T_4	T_3	TSH
Dopamine	d	d	d	d
Corticoid	d	d	d	d
Metoclopramide	n	n	n	i
Sulfa, Sulfonylurea	d	d	d	i
Phenylbutazone	d	d	d	i
Iodides	d	d	d	i
Li CO 3	d	d	d	i
Estrogen	l	n	i	n
Androgen	d	n	d	n
Phenytoin	d	d	n	n
Propranolal	n	n	d	-
Amiodarone	i	i	i	d

d-Decreased i-Increased n- No effect

Thus in summary before interpreting Thyroid function results one should know the age, sex, general condition, intercurrent illness, its severity, and the drugs patients is receiving (including Thyroxin, PTU/neomercazole). In fact requisition form for TFT should include all this information.

With this information one concludes that FREE T_4 and Supersensitive TSH Assay are the only two really useful tests one can order in most of the situations.