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THYROID FUNCTION TESTS INFORMATION SHEET

INTRODUCTION

Thyroid function tests are used in two main circumstances. The first is diagnostic testing to identify and classify any disorders of thyroid functioning. The second is to monitor the effects of treatment of known thyroid disease. The measurement of thyroid stimulating hormone (TSH) plays a vital role in investigating and monitoring thyroid function. There is a linear/logarithmic relationship between free thyroxine (FT4) and TSH, meaning that a 2 fold change in FT4 level will normally result in a 10-20 fold change in TSH level. This makes TSH a very sensitive indicator of dysfunction of the thyroid gland.

INDICATIONS FOR THYROID DIAGNOSTIC TESTING

Testing for disorders of thyroid function should performed whenever there are clinical findings suggestive of thyroid disease. In addition there are certain circumstances when there is an increased risk of thyroid disease, and it may be appropriate to test for abnormalities of thyroid function. Risk factors for hypothyroidism include: age over 60 years, female sex, goitre, previous hyperthyroidism, history of thyroiditis, family history of thyroid disease, history of head or neck cancer, Down Syndrome, other auto-immune diseases, treatment with lithium or amiodarone, or elevated serum cholesterol.

In most circumstances the initial test of choice is TSH alone. However, in certain conditions the relationship between TSH and FT4 may be disrupted and it is necessary to measure TSH and FT4. These conditions are defined in the Medicare Benefits Schedule and the condition must be written on the request form.

1. Hospital inpatients
2. Suspected pituitary dysfunction
3. Psychiatric illness or dementia
4. Investigation of amenorrhoea or infertility
5. Treatment with drugs likely to affect thyroid function, eg glucocorticoids, amiodarone, phenytoin, lithium or carbemazepine.

Note that with hospital inpatients, or in any person with a serious intercurrent disease, thyroid function tests should only be performed if there is a strong clinical suspicion of thyroid disease. Serious illness causes derangements of thyroid function tests, known as the sick euthyroid syndrome, which do not reflect endocrine disease and does not indicate a need for treatment.

INTERPRETATION OF TSH FOR DIAGNOSIS OF THYROID DISEASE

Normal TSH alone: thyroid disease unlikely, no further testing required. If testing for possible hypothyroidism in a high risk patient it is unnecessary to test for another five years. If the TSH is outside the reference interval a FT4 should also be measured. Once a TSH and a FT4 have been measured certain common patterns can be interpreted (see table).

There are many other patterns which the laboratory is able to help with interpretation and guide to additional testing.

MONITORING THYROXINE TREATMENT

TSH measurement is the mainstay for monitoring thyroxine treatment in most cases. If there is pituitary disease or in the first few months after treatment of hyperthyroidism FT4 should be measured. When monitoring thyroxine treatment it is necessary to write on the request form that the patient is receiving treatment with T4 or T3. Measurements should not be made until at least 6 weeks after starting treatment or after changing dose as it takes this long to achieve a steady state. Once a stable dose has been achieved tests should be made 2 to 3 times per year. The aim of treatment is to maintain the TSH within the lower half of the reference interval for normal individuals. In order to achieve this the FT4 will commonly be near the top of the reference interval.

MONITORING TREATMENT FOR HYPERTHYROIDISM

Due to the relative rarity of hyperthyroidism, treatment is commonly managed by an endocrinologist. FT4 is the mainstay of monitoring and should be measured every few weeks after commencing treatment. TSH remains low for some time after the normalisation of the FT4 and should be measured if the FT4 falls to low normal levels, the thyroid gland enlarges, or symptoms suggest hypothyroidism.

SICK EUTHYROID SYNDROME

Persons who are seriously ill often have changes in thyroid function tests but this does not usually indicate thyroid dysfunction. Common changes include low TSH (but not fully suppressed), or slight elevation or depression in FT4. These changes can occur in starvation as well as with systemic disease. During recovery from a severe illness the TSH may be transiently elevated. Note that the sick euthyroid syndrome does not usually mimic the changes of frank hyper- or hypothyroidism.

DRUG EFFECTS

A number of medications are well known to affect thyroid function. Glucocorticoids and dopamine can lower the serum TSH level; lithium may cause hypothyroidism in 5 - 10% of patients, iodide, as used in iodine-containing sterilising solution, radio-opaque dyes or amiodarone, can cause hyperthyroidism in predisposed individuals; amiodarone can itself directly cause hyper- or hypothyroidism by a direct effect on the thyroid gland.

PHYSIOLOGICAL CHANGES IN THYROID FUNCTION TESTS

Normal adult thyroid function tests concentrations are reached within 1 month of birth and remain constant throughout adult life into old age. In the first month of life higher levels of TSH are expected. During the second and third trimester of pregnancy there may be slight fall in the circulating concentration of free T4.

PITUITARY DISEASE

Disorders of pituitary gland are relatively rare as a cause of thyroid dysfunction. A pituitary cause of hypothyroidism will have a low or normal TSH together with a low FT4. If this is suspected other pituitary hormones should be investigated along with physical examination and pituitary imaging. It would be appropriate to measure prolactin, LH, FSH, cortisol and (in males) testosterone. Pituitary causes of hyperthyroidism are exceedingly rare and the pattern of elevated TSH and FT4 is more likely to be due to thyroid hormone resistance, an inherited defect of the thyroid hormone receptor.

Diagnostic Thyroid Function Testing*		
TSH (miU/L)	**FT4 (nmol/L)**	**Likely Diagnoses**
> 4.2	< 11	Hypothyroidism
4.2 - 10	11 - 22	Subclinical hypothyroidism
0.4 - 4.2	11 - 22	Normal
0.02 - 0.42	11 - 22	Subclinical hyperthyroidism Drugs (esp corticosteroids)
0.02 - 4.2	10 - 24	Sick euthyroid syndrome
< 0.02	> 22	Hyperthyroidism
< 0.02	11 - 22	Possible T3 toxicosis, measure FT3
*For monitoring thyroid disease treatment see text		