

THYROID DYSFUNCTION

Hypothyroid



- Hair loss
- Fatigue
- Sensitivity to cold
- Constipation
- Increased cholesterol
- Weight gain
- Dry skin

Hypothyroidism is underactive thyroid
Thyroid gland under-produces the Thyroid Stimulating Hormone.

Hyperthyroid



- Fine, brittle hair
- Trouble sleeping
- Excessive sweating
- Weight loss
- High blood pressure
- Anxiety
- Moist skin

Hyperthyroidism is overactive thyroid
Thyroid gland over-produces the Thyroid Stimulating Hormone.



20.4 Classification of thyroid disease

	Primary	Secondary
Hormone excess	Graves' disease Multinodular goitre Adenoma Subacute thyroiditis	Pituitary TSHoma
Hormone deficiency	Hashimoto's thyroiditis Atrophic hypothyroidism	Hypopituitarism
Hormone hypersensitivity	–	
Hormone resistance	Thyroid hormone resistance syndrome 5'-monodeiodinase deficiency	
Non-functioning tumours	Differentiated carcinoma Medullary carcinoma Lymphoma	

Hyper- or hypothyroidism can be 1°, 2°, 3°

DIABETES AND THYROID DISORDERS

Type 1 diabetes (inability of the pancreas to secrete insulin), **Hashimoto's thyroiditis** (hypothyroidism) and **Graves disease** (hyperthyroidism) are all autoimmune diseases of endocrine gland

30% of type I diabetic females also have thyroid dysfunction, and 20% of type 1 diabetic children have thyroid antibodies

Imp test

hyperthyroidism can increase the risk of developing diabetes mellitus and can worsen blood sugar control in a diabetic person

Hypothyroidism can **increase the risk of heart disease** in patients with diabetes mellitus

CAUSES OF HYPERTHYROIDISM

Overproduction of thyroid hormones

- 1- graves' dz
- 2- TSH secreting pit. Adenoma (toxic)
- 3- Multinodular Goitre (toxic)

Leaking Thyroid hormone due to thyroid destruction

- 1- lymphocytic thyroiditis
- 2- subacute thyroiditis
- 3- radiation

Drugs

- 1- thyroid replacement drugs
- 2- amiodarone
- 3- iodinated radio contrast agent

Metastatic Thyroid Ca.

Sx of Graves' Dz:

Fatigue, finger/hand tremors, weight loss, heat sensitivity, enlargement of thyroid gl.

Some other sx of hyperthyroidism not prev. mentioned:

Irritability, restless, oligo-/amenorrhoea (thin & nervous)

HYPOTHYROIDISM

Newborn

- 1- cretinism
- 2- Lack of myelination

Children

- 1- retarded growth
- 2- disproportionate

Adult

- 1- Muscle weakness
- 2- Tired/fatigued
- 3- Anaemia/Cold
- 4- Slowed intestinal peristalsis
- 5- Impaired renal function
- 6- Myxoedema
- 7- Mental slowness

CAUSES OF HYPOTHYROIDISM

1°

- 1- Iodine deficiency
- 2- excess iodide intake
- 3- thyroid ablation
- 4- hashimoto's thyroiditis
- 5- subacute thyroiditis
- 6- genetic abnormalities
- 7- goitrogenic food
(eg cabbage)
- 8- drugs
 - lithium
 - Amiodarone
 - Antithyroid drugs

2°

- hypopituitarism
- 1- adenoma
 - 2- ablative therapy
 - 3- pituitary destruction

3°

- 1- hypothalamic dysfunction
<very rare>

-**Goitre**=abnormal enlargement of the thyroid gland
-**Goitrogenic foods** = foods that can affect thyroid function by inhibiting synthesis of thyroid hormones, resulting in goitre
-**amiodarone**: high iodine content; can lead to both hypothyroidism (more commonly) and hyperthyroidism
-**cretinism**=congenital thyroid hormone deficiency (usually owing to a hypothyroid mother)-> severely stunted physical & mental growth
-**hashimoto's** = chronic lymphocytic thyroiditis, autoimmune, painless goitre

EUTHYROID SICK SYNDROME

OSMOSIS

- Non-thyroidal systemic illnesses or Catabolic states (starvation)
 - deficiency of thyroid hormones (T3) → body conserves energy → less deiodinase → less T3
 - @ inflamm: IL-6/TNF- α /IFN- γ → act directly on hypothalamus + pit. Gland → dec TSH T3 T4
 - Tx: underlying illness; Recover/eat again → no ESS anymore
 - Dx: based on excluding hypothyroidism
-
- Patient presents and complains of hypothyroid type symptoms
 - Levels of Thyroid hormones (free & total), & TSH in low normal range.
 - May be due to a **5'-deiodinase deficiency**
 - Occurs in acute and chronic illness. (e.g renal failure, liver failure, pancreatic dz)
 - Derangements of thyroid hormone levels are due to:
 - alterations in peripheral metabolism of T4
 - binding of T4 to TBG.
 - Fasting or illness → decrease the magnitude of TSH pulsations.
 - **Low T4 belays poor prognosis.**

Severity of Illness	Free T4	Free T3	Reverse T3	TSH
Mild	Normal	Reduced up to 50%	Increased up to twofold	Normal
Moderate	Increased	Reduced up to 90%	Increased up to several fold	Normal
Severe	Reduced	Almost undetectable	Variable	Reduced

THYROID HORMONE RESISTANCE

- Mutation of the receptor.
- Characterised by high blood levels of **both** TSH and Thyroid hormones

NON-TOXIC GOITRE

- Iodine deficiency

THYROID TESTS

- **Thyroid Profile Total = Total T3 + Total T4 + TSH** ← ideal
- Dx mainly by sx due to high \$\$\$. Detecting lab levels isn't that necessary and it's done mainly to assist the severity of dysfunction & drug dosing.
- Thyroid profile is done to:
 - Diagnose any suspected thyroid dz
 - Monitor tx in patients w/ thyroid dz
 - To investigate a cause of infertility
- What tests do:
 - Measure conc of products by thyroid gl.
 - Free T4, Total serum T4, free T4 index, serum T3 resin uptake, total serum T3
 - Evaluate integrity of HPT axis
 - TSH, TRH
 - Assess inherent thyroid fx
 - Radioactive iodine uptake
 - Detect Ab to thyroid tiss.
- Measurement of FT4-> **DED (direct equilibrium dialysis)**
- **T3 resin uptake** is Never used alone for dx. Used only to calculate **FT4 index**
- **TRH test** is performed by drawing baseline serum TSH & administer approx. 200-400 ug of TRH IV over 30-60 sec, then TSH conc. Drawn at 30-60 mins.

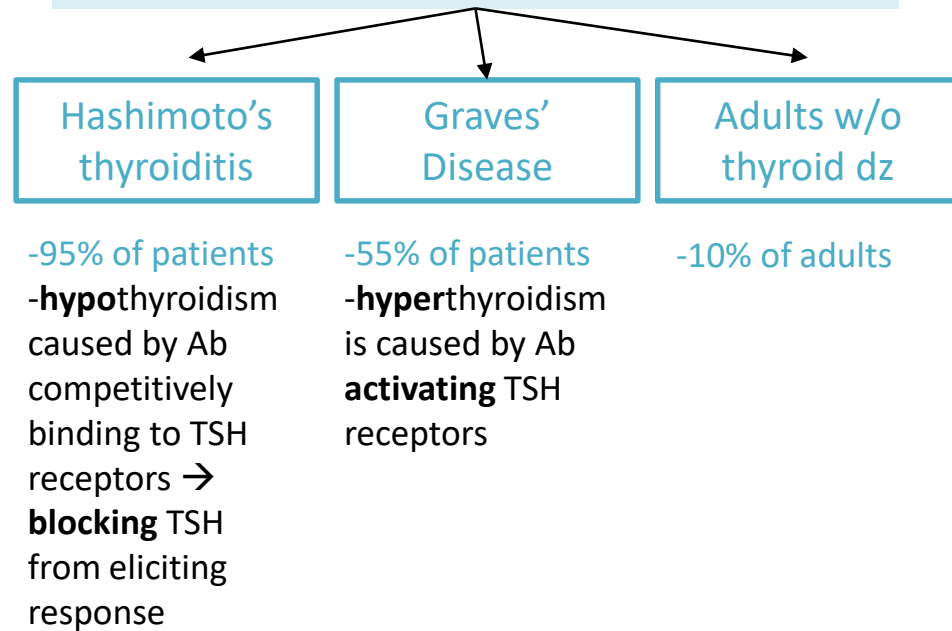
	Reference Range	Measures	Increased	Decreased
Free T4	0.8-2.7 ng/dl	Unbound fraction of T4	↑free T4 & <0.01 TSH: non-pit. hyperthyroidism	↓free T4 & ↑TSH: 1° hypothyroidism
Total Serum T4	2-12 ug/dl	Bound + free T4	Hyperthyroidism/↑[TBP]	Hypothyroidism/↓[TBP] /non-thyroid illness (e.g DM, liver dz, renal failure, prolonged infection, CVD)
Serum T3 Resin uptake (thyroid hormone binding ratio)	25-35%	Indirectly estimates # of binding sites on TBPs occupied by T3 (high when TBP is low)	Hyperthyroidism	Hypothyroidism
FT4 Index	1.2-4.2	Total serum T4* T3 resin uptake	Hyperthyroidism	hypothyroidism
Total Serum T3	78-195 ng/dl	To detect T3 toxicosis (↑T3 & normal T4)		
TSH	0.3-5 mu/L or μu/ml	Assess integrity of HPT axis	>20 mu/L: symptomatic 1° hypothyroidism 10-20 mu/L: mild symptomatic hypothyroidism	<0.05: 1° hyperthyroidism
TRH		Assess integrity of HPT axis-ability to stim. Pit.	TSH >5 μu over baseline: euthyroid state Significant increase rules out hyperthyroidism	

RADIOACTIVE IODINE UPTAKE TEST

- Not specific—adjusted based on local pop.
- Indirect measure of thyroid activity
- assess inherent thyroid fx.

Thyrotoxicosis	hypothyroidism
Iodine deficiency	Euthyroid patients
Post thyroiditis	Acute thyroiditis
Withdrawal rebound after: -thyroid hormone -antithyroid drug therapy	Patients on exogenous thyroid hormone therapy
	Patients taking antithyroid drugs

ANTITHYROID ANTIBODIES

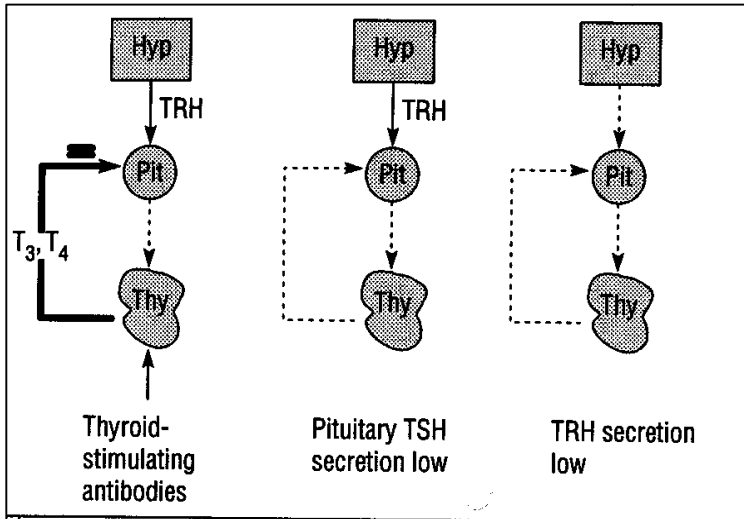


Best initial test for thyroid fx: **serum TSH**

- latest gen. of this assay has high sensitivity
- excellent for screening for those w/ low pretest probability of thyroid dz eg **newborns**
- high** (>5.0 mU/L) → indication for further testing e.g FT4 or FTI
- grey zone** (4.1-5 mU/L) → v likely to develop hypothyroidism → should be screened regularly

Summary

Disease	Total serum T4	Total serum T3	T3 resin uptake	Free T4 index	Radioactive iodine uptake test	TSH
Hypothyroidism	↓	↓	↓	↓	↓	↑ 1° ↓ 2°, 3°
Hyperthyroidism	↑	↑	↑	↑	↑	↓
T3 toxicosis	No change	↑	No change	No change	No change	↓
Euthyroid sick syndrome	No change	↓	↑	variable	No change	No change



Autoimmune disease
TSH receptor-like antibodies stimulate thyroid release
Massive inhibition of TSH release

Pituitary problem
Low TSH release, therefore low thyroid release

Hypothalamic problem
Low TSH and thyroid release

