

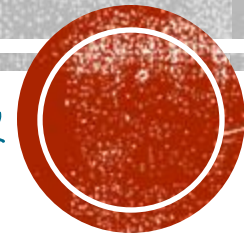
# OTHER COMMON TESTS

\* من الفحوصات التي تبين للطفل عنده الولادة.

عشان يشوفوا اذا عنده congenital hypothyroidism  
TSH →

(بعد اسبوع من الولادة بالعادة يتم عمل الفحص هاد)

لجنا الأشخاص الي عندهم diabetes  
عندهم ليس عندهم اضطراب بالبنكرياس  
والعكس.



T<sub>3</sub> ← يحفز عليه تصنيع البروتينات المختلفة.

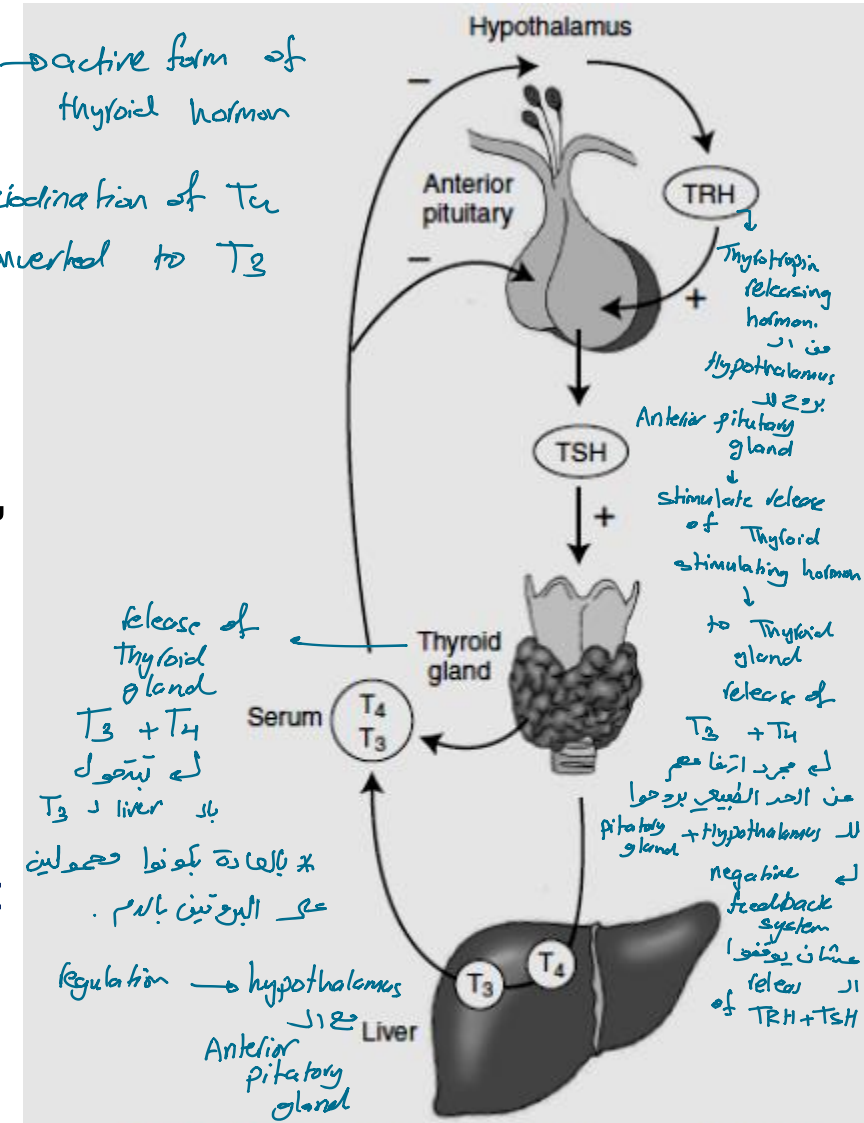
# THYROID FUNCTION TESTS

- Once released from the thyroid gland, thyroid hormone circulates in the bloodstream where free T<sub>4</sub> and T<sub>3</sub> are available to travel across the cell membrane. In the cytoplasm, T<sub>4</sub> is deiodinated into T<sub>3</sub>, the active form of thyroid hormone. T<sub>3</sub> combines with its nuclear receptor on thyroid hormone-responsive genes, leading to production of messenger RNA that, in turn, leads to production of proteins that influence metabolism and development.
- Effects include tissue growth, brain maturation, increased heat production, increased oxygen consumption, and an increased number of adrenergic receptors.
- Clinically, individuals who have excess thyroid hormone (thyrotoxicosis) will have symptoms of increased metabolism such as tachycardia and tremor, while individuals with hypothyroidism note symptoms of lowered metabolism like edema and constipation.

obesity

increase production of heat + ↑ O<sub>2</sub> consumption

T<sub>3</sub> → active form of thyroid hormone  
deiodination of T<sub>4</sub> → converted to T<sub>3</sub>



**FIGURE 22-3.** Hypothalamic-pituitary-thyroid axis. Thyrotropin-releasing hormone (TRH) stimulates the production and release of thyrotropin (TSH). TSH stimulates the thyroid gland to synthesize and secrete thyroid hormone. T<sub>4</sub> that is released by the thyroid gland is mostly converted to T<sub>3</sub> by the liver and kidney. T<sub>3</sub> and T<sub>4</sub> feedback inhibit TSH release directly through action at the pituitary and indirectly by decreasing TRH release from the hypothalamus. (Adapted with permission from Surks MI, Sievert R. Drugs and thyroid function. N Engl J Med 1995;333:1688.)

# THYROID FUNCTION TESTS

## Thyroid function tests:

- **TSH** (Thyroid stimulating hormone)
- The most useful test for assessing thyroid function is the TSH.
- All the assays are capable of diagnosing primary hypothyroidism by low thyroid hormone production and elevated levels of TSH.
- Second-generation TSH immunometric assays, with detection limits of 0.1 mU/L, can effectively screen for hyperthyroidism, but third-generation TSH chemiluminometric assays, with detection limits of 0.01 mU/L, are less likely to give false-negative results and can more accurately distinguish between euthyroidism and hyperthyroidism.

\* In hypothyroidism → all hormones at high level

\* In hyperthyroidism → TSH low level

\* يمكن دقة الفحص - أكثر عند  
يستخدم فحص الـ hyperthyroidism  
① immunometric assay. (antigen-antibodies)  
② chemiluminometric assay.



# ① TSH

Subclinical :

① لسا حافي عليه اي ايمان

② ال T<sub>4</sub> لسا تعالي اد

normal level

③ يكون الارتفاع اقل النقصان في ال TSH

Hyperthyroidism → normal function of thyroid gland with balance hormone level.

- Second- and third-generation TSH assays are routinely used to monitor and adjust thyroid hormone replacement therapy as well as screen for both hyperthyroidism and hypothyroidism.

دقة عالية جداً

- The sensitivity of the third-generation TSH assays has led to the ability to detect subclinical disease or a mild degree of thyroid dysfunction due to the large reciprocal change in TSH levels seen for even small changes in free T<sub>4</sub>.

↓  
في ال  
Thyroid gland  
عند عشر مجس

→ يكون لسا حافي عين  
عليه ايمان

↑ TSH + normal level of T<sub>4</sub> or at lower normal limit

- In subclinical hypothyroidism, the TSH is minimally increased while the free T<sub>4</sub> stays within the normal range. Likewise, in subclinical hyperthyroidism, the TSH is suppressed while the free T<sub>4</sub> is normal.

→ ↓ TSH + normal level of T<sub>4</sub>

\* علاقة عكسية بين ال TSH و ال T<sub>4</sub> + T<sub>3</sub>





## ② T3 AND T4

→ measured by (antigen-antibody)  
 → radioimmuno assay.  
 → chemiluminometric assay.  
 → immunometric assay

- Serum total T4 and T3 levels are usually measured by **radioimmunoassay (RIA)**, **chemiluminometric assay**, or similar **immunometric technique**. Because more than 99.9% of thyroid hormone is protein bound, alteration in thyroid hormone-binding proteins, unrelated to thyroid disease, frequently lead to total T4 and T3 levels outside of the normal range.  
 ↓  
 problem in proteins that bind with T3 + T4  
 ↓  
 prealbumin.
- Because of this, assays have been developed to measure **free T4 and T3**, the biologically active forms of thyroid hormone
- Currently available assay kits for measuring free T4 levels are not error proof, though, and can still be affected by some binding protein abnormalities. When this is suspected, measurement of **free T4 levels is performed by dialysis**.

Chemiluminometric → بكون في عدي مع الـ antibody مرتبط enzyme والتفاعل تبعه  
 بعبارة luminometer ← زي افادة وهاي تتناسب لمرتبة  
 مع كمية الـ antibodies اللي شفاعت مع الـ antigen.

protein bound  
 قابلية من حلال الـ  
 membrane.



# THYROGLOBULIN

$T_3 + T_4$  Test  
 فيهم نسبة خفا  
 لأنه أغلبهم  
 protein bond  
 free  
 بقيس ال  
 وعشان اتجنب ال  
 dialysis بالقرارة بغير error

حسك بيبي أقل screening عام بروج بقيس ال  
 $TSH$  اذا فيه خلل وعشان نتأكد  
 بروج بغير خلل  $T_4 + T_3$  دققها

indication for tumor.

- Thyroglobulin is a protein synthesized and secreted exclusively by **thyroid follicular cells**. Its presences in the circulation is proof of the **presence of thyroid tissue**, either **benign** or **malignant** so its used as a **tumor marker for thyroid cancer** patients. Patients with well-differentiated thyroid cancer who have been treated successfully with surgery and radioactive iodine ablation should have undetectable thyroglobulin levels.
- Thyroglobulin is currently measured by double antibody **RIA**, enzyme-linked immunoassay (ELISA), immunoradiometric assay (IRMA), and immunochemiluminescent assay (ICMA) methods.
- The accuracy of the thyroglobulin assay is primarily **dependent on the specificity of the antibody used and the absence of antithyroglobulin autoantibodies**. Even with modern assays, **antithyroglobulin autoantibodies** interfere with measurements and lead to unreliable thyroglobulin results. Approximately 25% of patients with well-differentiated thyroid cancer will have antithyroglobulin autoantibodies. This is approximately **twice as high as in the general population**.
- If a patient with well-differentiated **thyroid cancer and antithyroglobulin autoantibodies** has been successfully treated with surgery and **radioactive iodine ablation**, **autoantibodies should disappear over time**.

كلها معثرة على  
 antigen -  
 antibody reaction.

عشان  
 امير اذا  
 عنده  
 cancer  
 او  
 benign  
 problem.

لما خلا ارجع عينة ادم وبقيس خيرا  
 antibodies الـ أنا هنعثها في  
 antibodies منجوا جمع  
 نما بجز من الـ بغير  
 result.



# AUTOIMMUNE ANTIBODIES

آلسمه ایست که  
autoimmune disease.

- The most common cause of hyperthyroidism is an autoimmune disorder called
- **Graves' disease**: The antibody in this condition is directed at the TSH receptor and stimulates the receptor, leading to growth of the thyroid gland and production of excessive amounts of thyroid hormone. This condition can be diagnosed with tests that detect antibodies to the TSH receptor.
- Thyroid stimulating antibodies (TSA<sub>b</sub>) use a bioassay to determine presence of autoimmune hyperthyroidism. Tests for **TSH receptor antibodies** (TSHR-Ab) can detect antibodies directed against the TSH receptor whether they act to stimulate or block the TSH receptor. Both stimulating and blocking antibody assays will be positive in 70-100% of patients with Graves' disease.
- **Chronic lymphocytic thyroiditis (Hashimoto's thyroiditis)**: is the most common cause of hypothyroidism in the developed world. In this condition, antibodies lead to decreased thyroid hormone production by the thyroid gland. The best test for this condition is the **thyroid peroxidase (TPO) antibody**, which is present in 10-15% of the general population and 80-99% of patients with autoimmune hypothyroidism.

50

# THYROID TESTS INTERPRETATION

Tu ↓ + TSH ↑ = hypothyroidism

↓ Tu → TSH ↑ → hypothyroidism.

**TABLE 22-1 INTERPRETATION OF THYROID TESTS**

	LOW FREE T <sub>4</sub>	NORMAL FREE T <sub>4</sub>	HIGH FREE T <sub>4</sub>
<u>Low TSH</u>	Secondary hypothyroidism Severe nonthyroidal illness	Subclinical hyperthyroidism Nonthyroidal illness	Hyperthyroidism
<u>Normal TSH</u>	Secondary hypothyroidism Severe nonthyroidal illness	Normal	Artifical ← Pituitary hyperthyroidism Laboratory draw within 6 hours of thyroxine dose
<u>High TSH</u>	Primary hypothyroidism	Subclinical hypothyroidism	Test artifact Pituitary hyperthyroidism Thyroid hormone resistance

Normal TSH → ↓ Tu → Secondary hypothyroidism  
 Normal TSH → ↓ Tu → Severe nonthyroidal illness → Thyroid gland





radio active Thyroxine  
نقح فن هاي الغلو  
iodine يستعمل لتصنع ال Thyroxine ← يمكن أستوف قد يش كند

# OTHER TOOLS FOR THYROID EVALUATION

- **Nuclear Medicine Evaluation:** Radioactive iodine is useful in assessing the metabolic activity of thyroid tissue and assisting in the evaluation and treatment of thyroid cancer. Radioactive iodine can also be useful in the evaluation of thyroid nodules in the presence of a low or undetectable TSH.
- **Thyroid Ultrasound:** used to assess thyroid anatomy and characterization of palpable thyroid abnormalities
- **Fine-Needle Aspiration (FNA)** biopsy is often the first step and most accurate tool in the evaluation of thyroid nodules, which allows prompt identification and treatment of thyroid malignancies and avoids unnecessary surgery in most individuals with benign thyroid lesions.

خزعة  
ملاحظة بي جة جراحة اول  
benign لا malignant



ليس عليه فحص دوري بل هو حسب حالة المريض  
كل 3 اشهر (مراقبة يعني)

CEA ← فالله reference ← يمكن يختلف  
من شخص لشخص  
rang

لنفحصه قبل العملية لايسر diagnosis  
كامل رايه عنه detected دنفحص بعد العملية  
cancer

# TUMOR MARKERS

- ① Cancer can be detected and monitored using biologic **tumor markers**, that are produced either directly by the tumor or as an effect of the tumor on healthy tissue.
- ② They can be used for **Screening**, **Diagnosis**, and to **test the effectiveness of the treatment**
- ① **Carcinoembryonic antigen (CEA)** is the most widely used tumor marker for colorectal cancer and is also frequently elevated in lung, breast, and gastrointestinal tumors. CEA can be used to aid in the diagnosis, prognosis, and therapy monitoring of colorectal cancer but not screening
- ② **Human Chorionic Gonadotropin (hCG)** is elevated in trophoblastic tumors, choriocarcinoma, and germ cell tumors of the ovary and testis.

reference value  
range



# TUMOR MARKERS

→ percent

- ③ ■ **Prostate Specific Antigen (PSA)**: detection of total PSA has been used in screening for and in monitoring of prostate cancer, evidence for the usefulness in detecting free PSA as a fraction of total has been identified. Patients with malignancy have a lower percentage of free PSA
- ④ ■ **α-Fetoprotein (AFP)**: is an abundant serum protein normally synthesized by the fetal liver that is reexpressed in certain types of tumors. AFP is often elevated in patients with hepatocellular carcinoma (HCC) and germ cell tumors
- ⑤ ■ **Cancer Antigen 125 (CA-125)**: It may be useful for detecting ovarian tumors at an early stage and for monitoring treatments without surgical restaging. ①

لے دے برقعہ کا حامل برہمنی اُمرانہ حصہ عند الفل

تصنع عند الفل  
و نفع للأم

②



TABLE 31-4 ENDOCRINE TUMOR MARKERS

TUMOR MARKER	TUMOR TYPE	METHOD	SPECIMEN	CLINICAL UTILITY
<u>Homovanillic acid (HVA)</u>	<u>Neuroblastoma, pheochromocytoma, paraganglionoma</u>	HPLC	24-hr urine	Diagnosis of <u>neuroblastoma</u> <sup>a</sup>
<u>Vanillylmandelic acid (VMA)</u>	<u>Pheochromocytoma, paraganglionoma, neuroblastoma</u>	HPLC	24-hr urine	Diagnosis of <u>neuroblastoma</u> <sup>a</sup>
<u>Metanephrines (fractionated)<sup>b</sup></u>	<u>Pheochromocytoma, paraganglionoma, neuroblastoma</u>	HPLC	24-hr urine or plasma	Screening and diagnosis of <u>pheochromocytoma</u> <sup>c</sup>
<u>Catecholamines (fractionated)<sup>b,d</sup></u>	<u>Pheochromocytoma, paraganglionoma, neuroblastoma</u>	HPLC, LC-MS/MS	24-hr urine	Screening and diagnosis of pheochromocytoma, paraganglionoma, neuroblastoma <sup>c</sup>
<u>Hydroxyindoleacetic acid (5-HIAA)</u>	<u>Carcinoid tumors</u>	HPLC	24-hr urine	Diagnosis of carcinoid tumors <sup>e</sup>
<u>Serotonin</u>	<u>Carcinoid tumors</u>	HPLC	Serum	Diagnosis of carcinoid tumors <sup>e</sup>
<u>Calcitonin</u>	<u>MTC and neuroendocrine tumors</u>	IA	Serum	Screening, <sup>f</sup> response to therapy, and monitoring recurrence of MTC
<u>Parathyroid hormone (PTH)</u>	<u>Pituitary adenoma</u>	IA	Serum	Diagnosis and postsurgical monitoring of 1 <sup>o</sup> hyperparathyroidism
<u>Growth hormone (GH)</u>	<u>Pituitary adenoma, ectopic GH-secreting tumorsurgical</u>	IA	Serum	Diagnosis and post monitoring of acromegaly
<u>Prolactin (PRL)</u>	<u>Pituitary adenoma</u>	IA	Serum	Diagnosis and postsurgical monitoring of prolactinoma
<u>Adrenocorticotrophic hormone (ACTH)</u>	<u>Pituitary adenoma, ectopic ACTH-producing tumor</u>	IA	Serum	Diagnosis of ectopic ACTH-producing tumor
<u>Cortisol</u>	<u>Adrenal tumors</u>	IA	Serum or urine	Diagnosis of Cushing's syndrome, adrenal adenoma
<u>Antidiuretic hormone (ADH)</u>	<u>Posterior pituitary tumors</u>	IA	Serum	Diagnosis of SIADH
<u>Chromogranin A</u>	<u>Pheochromocytoma, neuroblastoma, carcinoid tumors, small cell lung cancers</u>	ELISA, RIA	Serum	Aid in diagnosis of carcinoid tumors, pheochromocytomas, and neuroblastomas
<u>C-peptide</u>	<u>Insulin-secreting tumors</u>	ELISA, IA	Serum	Diagnosis of insulinoma

proteins زحطب الشغل المكونة من

immuno assay كنا مستخدم ال

amrkatat al'adaye nabi al  
vanillic acid

Catecholamines  
HPLC.

هاد الجدول الدكتور شرحته بالمحاضرة وركزت عشغلات بس  
للأسف ما لقيت ريكورد اله فلهيك حدث هالشغلات يلي شرحتها  
بمحاضرات الاونلاين  
ويعطيكم العافية ما تنسوننا من صالح دعائكم  
زميلتكم مرام الزياي

