

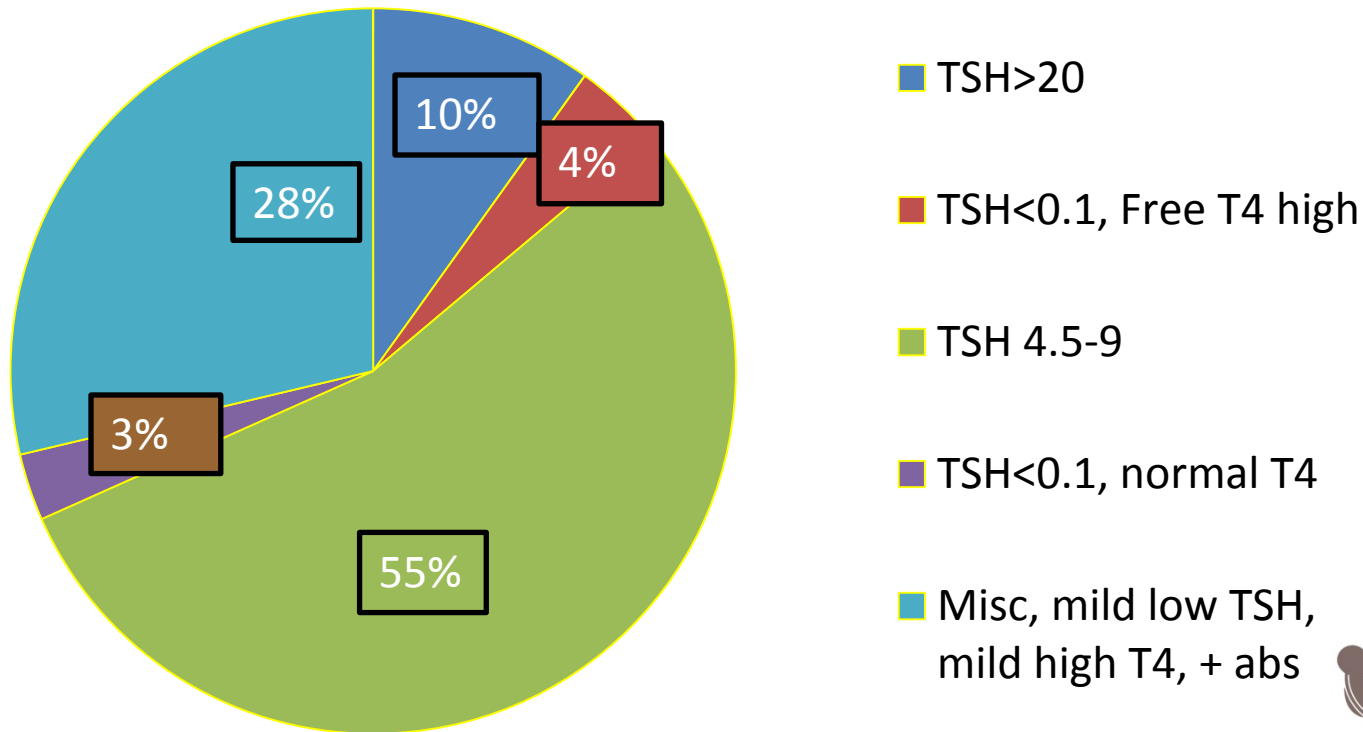
Thyroid disorders: A practical Approach

Priya Vaidyanathan, MD
Division of Endocrinology
Children's National Health System

Referral for Abnormal Thyroid Tests

Over a 2.5 yr period, our department received 1770 faxes with abnormal labs for review/appointment

877 (50%) were thyroid related



Background

Thyroid function tests (TFT) are commonly ordered in primary care offices

Abnormal TFT's are a substantial cause of referral to endocrine clinics

Our data shows that <20% of the abnormal TFT's require treatment

Kaplowitz, PAS abstract 2013

Objective

When to order thyroid function tests?

What to order?

Interpretation of results-Worrisome or not!

Management of common thyroid disorders

Thyroid nodule and cancer

Screening for Thyroid Disease

Routine screening in asymptomatic children not recommended

Routine screening in obese children not recommended

US Preventive Task Force

When to check TFT's ? Symptom /Sign based Approach

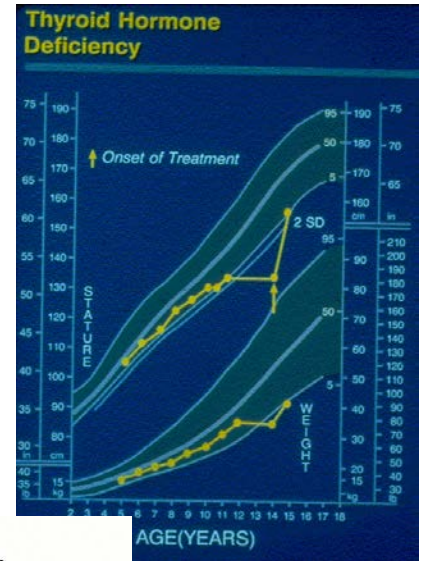
Thyroid enlargement

Suspected hypothyroidism;

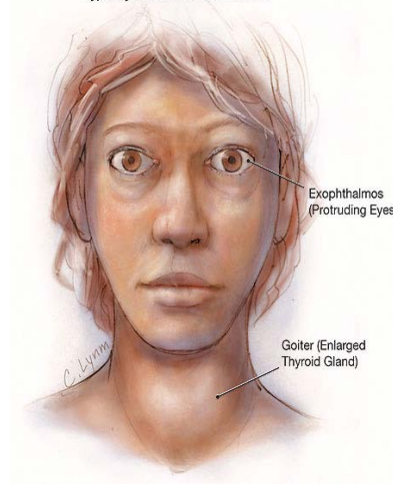
- Acquired growth failure (height not weight))
- Fatigue, constipation, cold intolerance
- dry skin, bradycardia
- delayed puberty, irregular periods
- +/- goiter

Suspected hyperthyroidism;

- Unexplained Weight loss
- Goiter, exophthalmos
- Tachycardia, tremors, Palpitations
- Diarrhea, heat intolerance
- Hyperactive, impaired school performance



Hyperthyroidism in Graves Disease



When to check TFT's? Know the risk factors

Newborn screen for congenital hypothyroidism

Down Syndrome: 4-18% risk for thyroid disorder

-screen in newborn, 6 months, 12 months and yearly

Turner Syndrome: every 1-2 yrs, >4 yrs of age

Autoimmune disorders: Type 1 diabetes, celiac disease

Family history of thyroid disease is a risk factor but there is no recommendation for routine screening

Drugs: Lithium, Amiodarone

Head and neck radiation

Health supervision for children with Down Syndrome, Pediatrics 2011

Health supervision for children with Turner Syndrome, Pediatrics 2003

Utility of the **different** thyroid tests

TSH

Good initial screening test

Limitation: Secondary hypothyroidism

Free T₄/T₄

Good screening test in conjunction with TSH

Diagnostic for secondary hypothyroidism

Diagnosis of hyperthyroidism

Direct Free T₄ is acceptable for screening

Free T₄ by equilibrium dialysis is more precise

Free T₃/ total T₃/T₃ uptake

Adds very little as a screening test

Thyroid Autoantibodies

Most acquired thyroid disorders are autoimmune

Thyroid peroxidase antibody (TPO) and Anti Thyroglobulin antibody (TgAb) are associated with Hashimoto thyroiditis

Thyroid stimulating immunoglobulin (TSI) or TSH receptor antibody associated with Graves disease

Order TPO antibody only in the presence of goiter or hypothyroidism

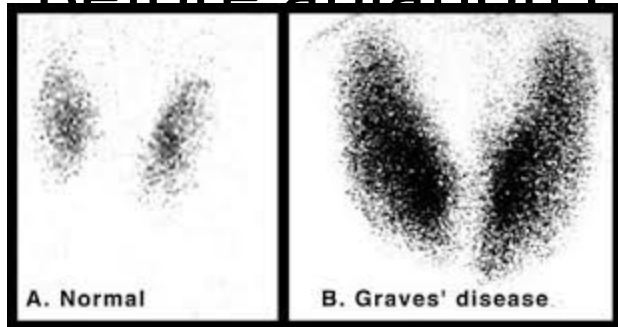
Prevalence of 1-5% in pediatric population

Only a small minority develop hypothyroidism

Thyroid Imaging

Uptake Scan(I-123)

- Ordered by Endocrinology
- Evaluation of toxic nodule
- Before ablation of
- in



- Thyroid sonogram

- If suspecting thyroid nodule
- Not routinely indicated



Interpretation of thyroid function test

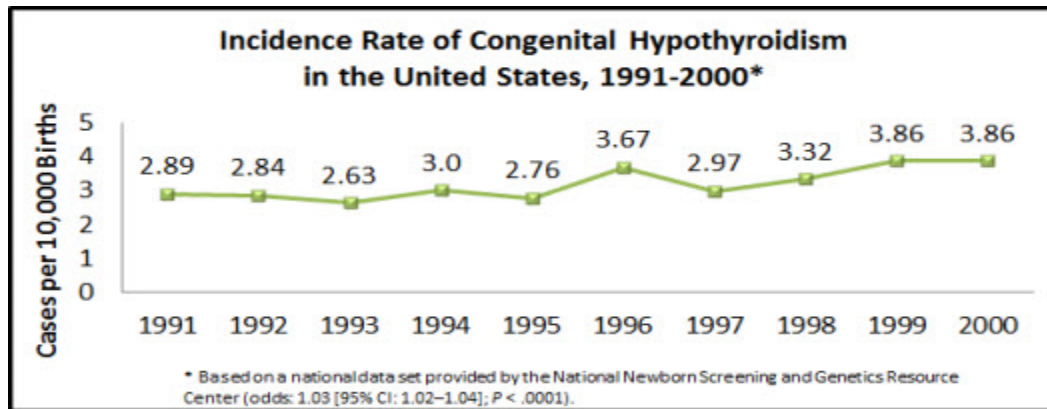
	TSH	T4	Free T4	T3	TSI	TPO	Dx
1.	112	4.5	0.8	-	-	155	Primary Hypothyroidism
2.	1.9	2.1	0.56	-	-	<20	Secondary Hypothyroidism
3.	1.9	2.1	1.4		-	-	TBG deficiency
4.	<0.01	18	4.2	425	400	90	Hyperthyroidism
5.	0.34	7.8	1.2	----	----	<20	Not worrisome
6	1.9	7.8	1.2	225	---	----	Not worrisome

Normal values:
 TSH 0.5-4.6 mcunit/ml
 T4 4.6-10.4 mcg/dl
 Free T4 0.9-1.6 ng/dl

Normal Values:
 T3 90-200 ng/dl
 TPO <20 IU/l
 TSI <120%

Congenital Hypothyroidism (CH)

1:3000-4000 newborns, sporadic inheritance



Females: Males=2:1



Newborn screen for Congenital Hypothyroidism

DC: Both TSH and T₄

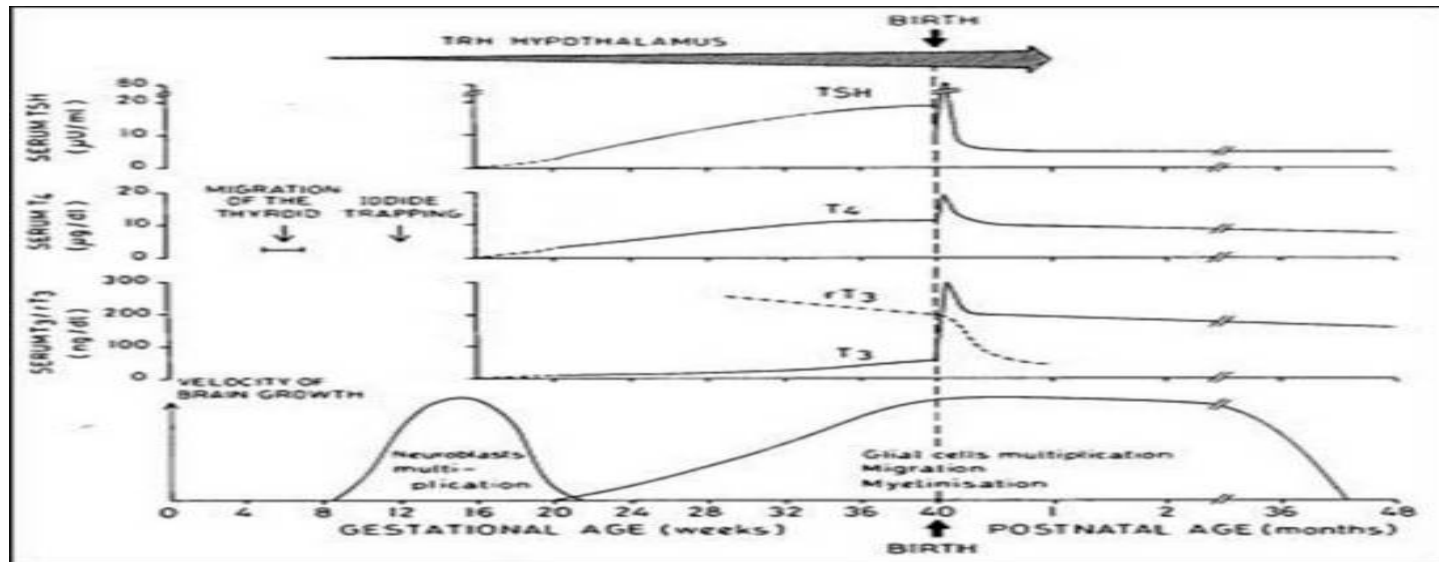
MD: T₄ with back up TSH ; Repeat 10-14 days

VA: TSH with back up T₄

TSH surge in first 24 hrs (false positive)

High TSH and Low T₄; confirm labs/call endocrinology

Treatment with L-thyroxine 10-15 mcg/kg/day (37.5 mcg/day)



Causes of CH

Ectopic thyroid - 25-50%

Thyroid agenesis - 20-50%

Dyshormonogenesis - 4-15%

Hypothalamic-pituitary dysfunction - 10-15%

Maternal thyroid disease (transient)



CH-Treatment and Outcome

Good neurocognitive outcomes when treated within 2-3 week of life

TSH and Free T₄ monitored frequently

Update of Newborn Screening and Therapy for Congenital Hypothyroidism-Pediatrics 2006

Acquired Hypothyroidism

Most commonly due to Hashimotos thyroiditis (autoimmune)

Familial

Peak incidence in mid puberty

TSH>10, L-thyroxine treatment is initiated

Dose based on age and TSH level

Post pubertal L-T₄ 1.5-2 mcg/kg/d

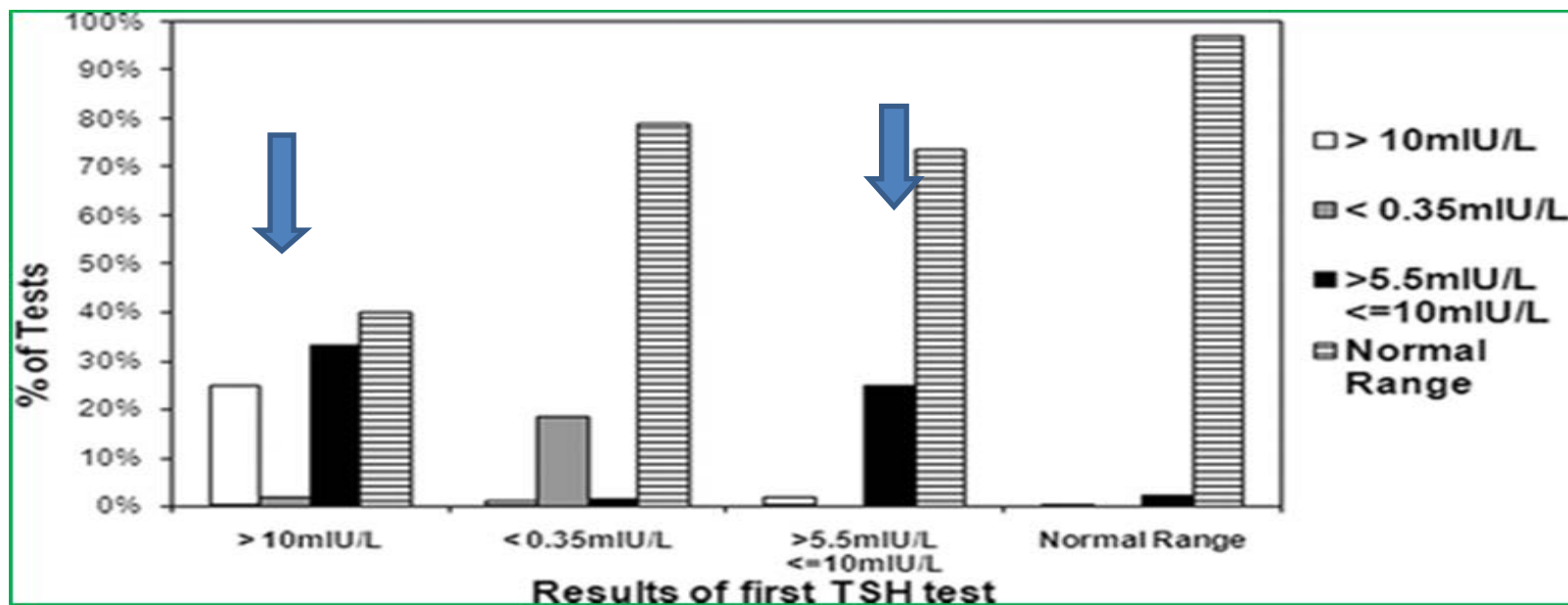


TSH 5-10 mU/L: Natural History of Subclinical Hypothyroidism

121502 patients between 0.5-16 yrs had TSH drawn in 2002 with follow up until 2007

2.9% had TSH 5-10

73% normalized and 8.3% progressed



Subclinical Hypothyroidism (SCH)

Is this a failing gland?



No

TSH normalizes or persists with low risk for progression

Risk of progression directly related to baseline TSH, goiter and + thyroid abs

Mild autoimmune thyroiditis, obesity, normal variation, mild developmental defect

No effect on growth and bone maturation, BMI or cognitive function

No benefit from L-thyroxine treatment (except in select cases with large goiter, +Abs)

Repeat TSH and Free T₄ in 6 months, check TPO antibody

Ewa Małecką-Tendera; Thyroid Research 2013
Kaplowitz; IJPE 2010

SCH in obese children

TSH 5-10 mU/L

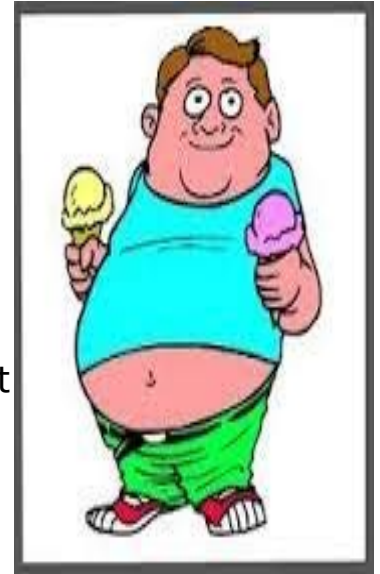
Most are thyroid antibody negative

Hypo echogenic thyroid gland

Leptin mediated inflammation

L-thyroxine replacement has no beneficial effect on body weight, BMI, height treated subjects

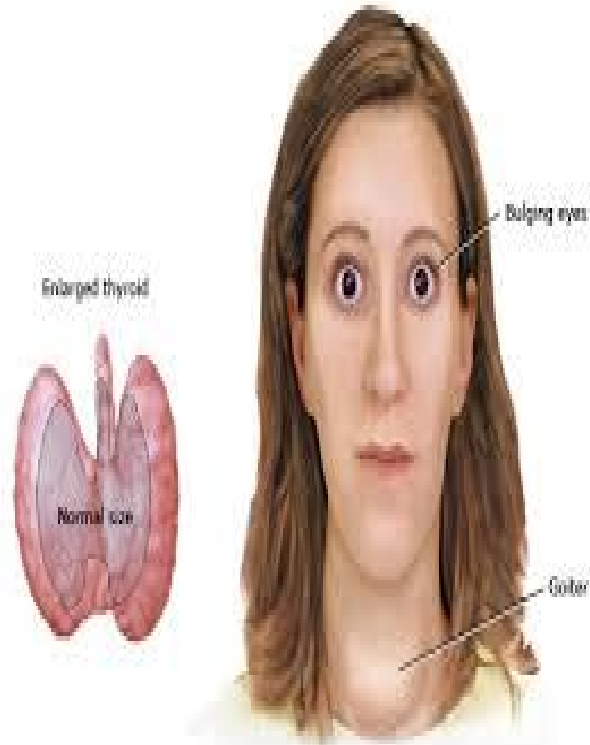
Lifestyle changes to control weight



Hyperthyroidism

17 y/o female reports being “out of breath and heart racing”. She has lost 15 lbs in 5 months, has difficulty sleeping and tires easily. There is diffuse enlarged thyroid gland, bruit on auscultation, tremors of her hands.

TSH <0.01 mcunit/ml, T₄ 17.4 mcg/dl (high)



Hyperthyroidism treatment

Methimazole; 5-20 mg/day.
Beta blockers if very symptomatic



50% chance of spontaneous remission in 2 yrs but can relapse

Permanent treatment if there are side effects, non compliance, no remission

Radioactive iodine ablation of the thyroid gland
Surgery (very young and in severe exophthalmos)
Outcome: Hypothyroidism

Subclinical Hyperthyroidism

TSH<0.01 with Free T₄ <2 ng/dl

Incidental and mostly asymptomatic

22 patients; only 9% progressed and 61% resolved on follow up

Hashitoxicosis, mild graves disease

Repeat TSH, Free T₄, T₃ in 2 months

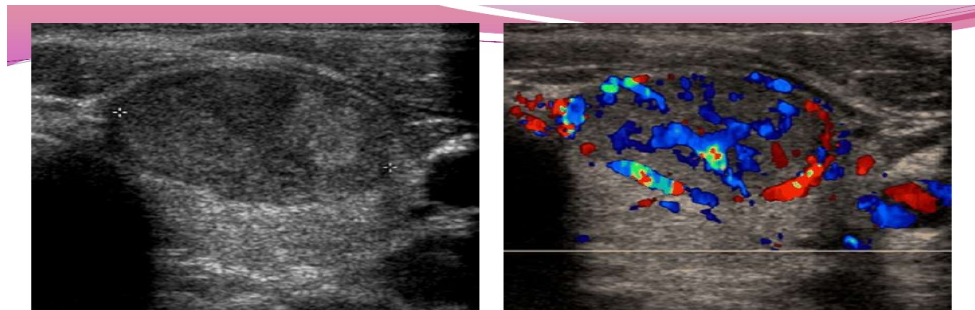
Vaidyanathan , Kaplowitz, JPEM 2010

Thyroid Nodule

Thyroid Sonogram is the imaging of choice

Concerning for malignancy are size $> 1\text{cm}$, hypoechoic nodule, irregular margins, microcalcifications

FNAC of suspicious nodules: ATA guidelines (no specific pediatric guidelines exist)



Role of color Doppler US. **(a)** Transverse gray-scale image of Predominantly solid thyroid nodule **(b)** Addition of color Doppler modes shows marked internal vascularity, indicating increased likelihood that nodule is malignant. This was a papillary carcinoma.

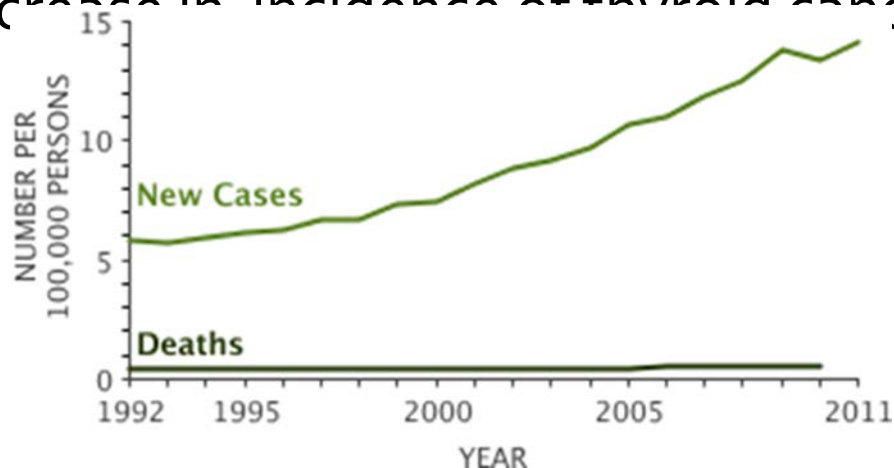
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Revised American Thyroid
Cancer, 2009

and Differentiated Thyroid

Thyroid cancer

SEER registry: Increase in incidence of thyroid cancer



Increasing incidence noted in children, rising 1.1 percent per year over the 31 year period

Well differentiated cancers (most are papillary thyroid cancers) with good prognosis

Treatment-total thyroidectomy and radioactive iodine

National Cancer Institute



Thyroid Nodule and Cancer Program at CNHS

Who and Where to refer?

Clinical suspicion of a thyroid nodule

Nodule with concerning features for cancer on the sonogram

Nodule size >0.5 cm on the sonogram.

Patients to be referred to endocrinology : 202-476-4134
(coordinator) or 202-476-3440 (appointment line)

Multidisciplinary Team: endocrinology, surgery, radiology,
pathology, oncology, genetics and nuclear medicine

Summary

Routine screening TFT's in asymptomatic or obese children not recommended

TSH and Free T₄ are the best screening test

TSH>10 are treated

Subclinical Hypothyroidism; no benefit from treatment; TSH, Free T₄ and TPO antibody in 6 months

Subclinical Hyperthyroidism; outcome variable , many resolve; TSH, Free T₄ and T₃ in 2 months

Minor lab variations are not pathological

Congenital Hypothyroidism: Send confirmatory TSH, Free T₄/refer to endocrine for immediate start of L-thyroxine, good outcome if treated within 2-3 weeks

Thyroid nodule and cancer program: call 202-476-3440 or 4134