
THYROID/PARATHYROID

Sheri Gillis Funderburk, MD

Endocrine Fellow

March 27, 2006

Topics

■ Thyroid

- Hypothyroidism
- Hyperthyroidism
- Thyroid Nodule
- Thyroid Cancer

■ Calcium

- Hypercalcemia
 - Hypocalcemia
-

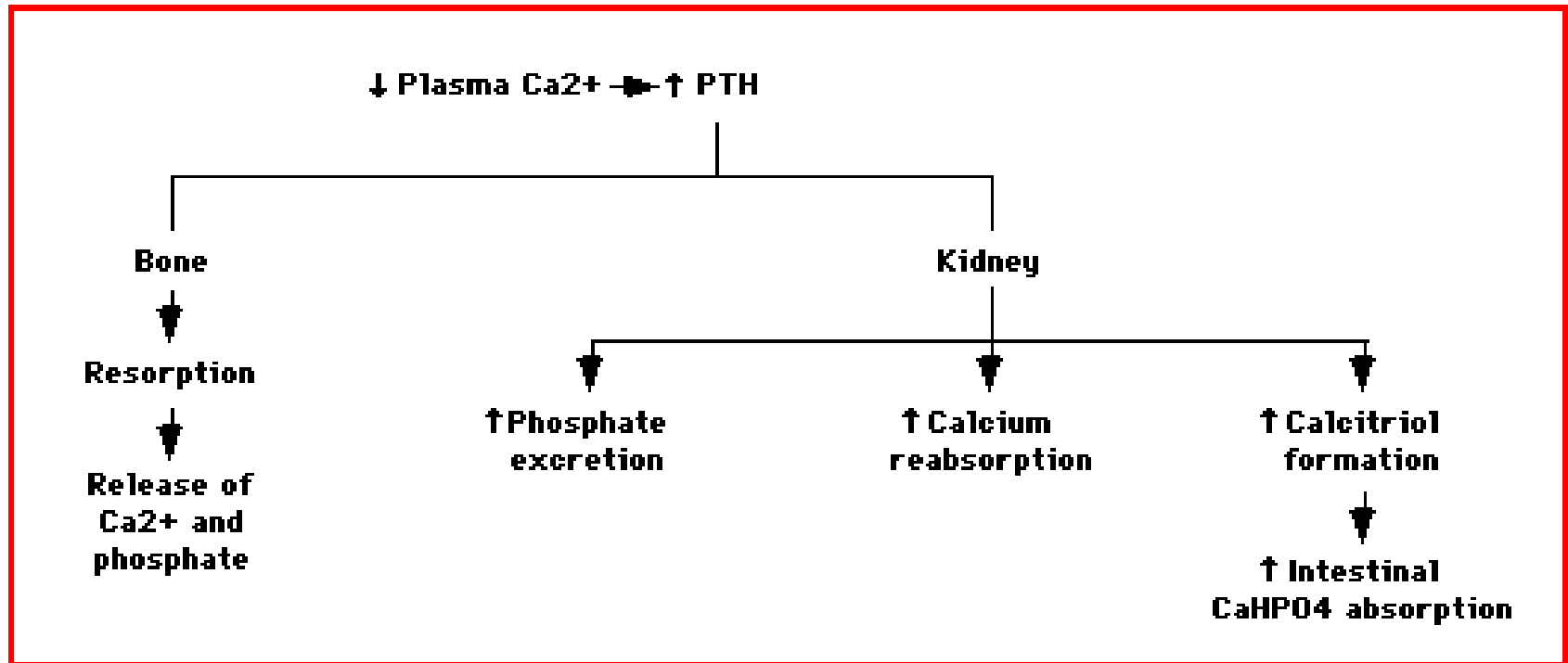
Calcium Homeostasis

- 99% body calcium in skeleton
 - 0.9 % intracellular
 - 0.1% extracellular
 - 50% bound
 - Mostly albumin (alkalosis)
 - Smaller amount phosphorous and citrate
 - Corrected calcium = $(4 - \text{serum albumin}) * 0.8 + \text{serum calcium}$
-

Calcium Regulation

■ PTH

- 4 parathyroid glands
 - Release PTH in response to drop in serum calcium
 - Magnesium needed to activate PTH release
 - Effects on bone, kidney and indirectly on intestines
 - Activates osteoclasts/osteoblasts leading to bone resorption and release of calcium and phosphorous
 - Promotes reabsorption of calcium and excretion of phosphorous in the kidney
 - Activates vitamin D
-



PTH homeostasis Effect of parathyroid hormone (PTH) on calcium and phosphate metabolism. The net effect is an increase in the plasma calcium concentration with no change or a decrease in the plasma phosphate concentration.

Calcium Regulation

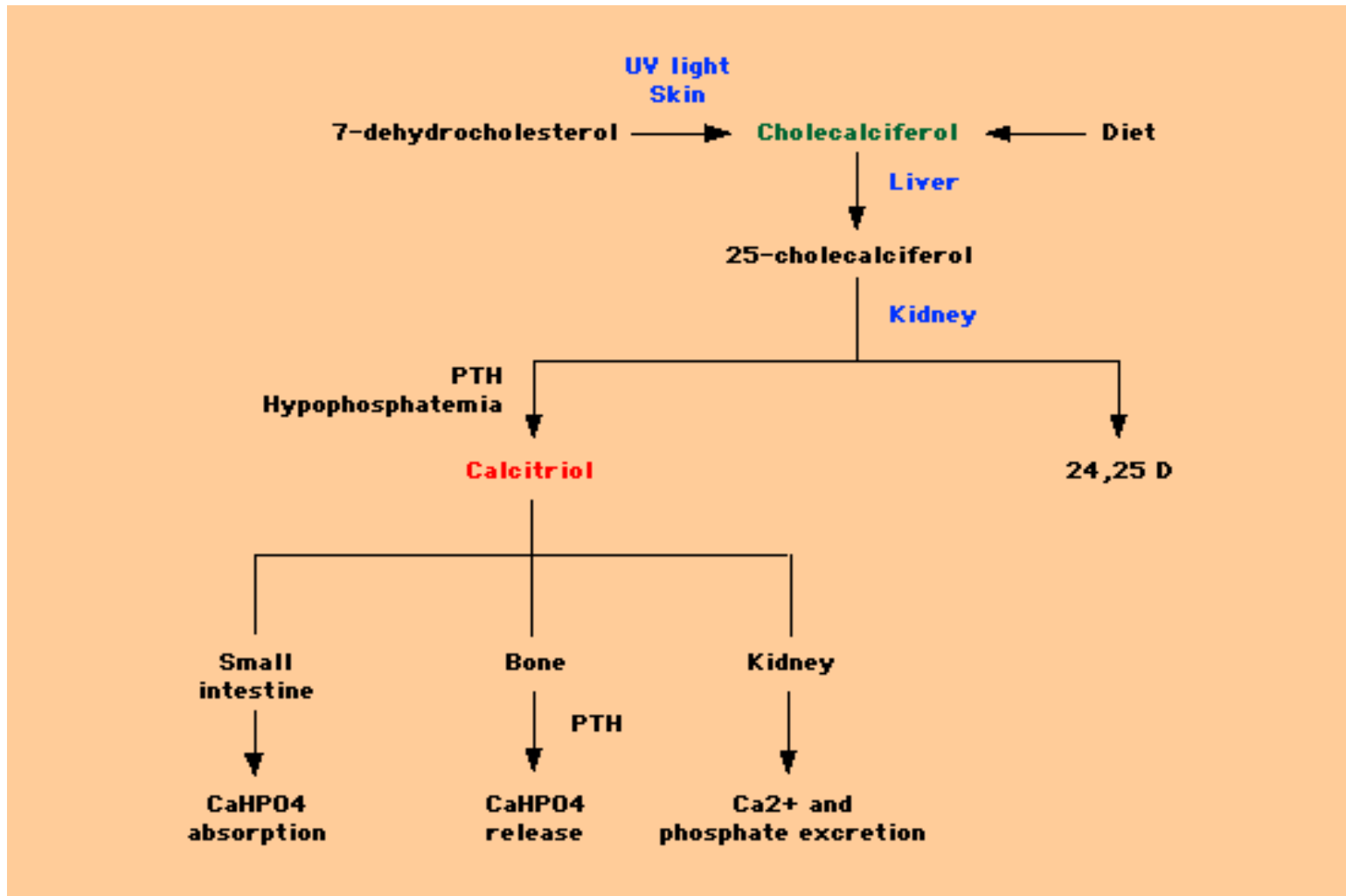
- Vitamin D
 - 2 sources
 - Skin and Diet

- 25 (OH) Vitamin D
 - Storage form Vitamin D
 - Liver

- 1,25 (OH) Vitamin D
 - Active form Vitamin D
 - Activated by PTH and hypophosphatemia through 1-alpha hydroxylase in the kidney

Calcium Regulation

- 1, 25 (OH) Vitamin D
 - Small intestine
 - Promotes absorption of calcium and phosphorous
 - Bone
 - Activates osteoblasts/osteoclasts leading to bone resorption and release of calcium and phosphorous
 - Parathyroid Gland
 - Decrease PTH mRNA
 - Kidney
 - Calcium and phosphate excretion
-



Vitamin D metabolism Metabolic activation of vitamin D to calcitriol and its effects on calcium and phosphate homeostasis. The result is an increase in the serum calcium and phosphate concentrations.

Calcium Homeostasis

- Calcitonin
 - Little role in calcium homeostasis
 - Secreted by C cells
 - Neural cell origin
 - Medullary Hyperplasia/Cancer
 - Most sporadic case
 - MEN IIA or IIB
 - 15 % cases
-

Hypercalcemia

- Symptoms and Signs
 - Only 20 % people exhibit signs of hypercalcemia
 - “Stones, bones, abdominal groans, and psychic overtones”
-

Manifestations of hypercalcemia

- Central nervous system dysfunction
- Muscle weakness
- Bowel hypomotility and constipation
- Increased gastrin secretion and (?) peptic ulcer disease
- Pancreatitis
- Acute and chronic renal insufficiency
- Nephrogenic diabetes insipidus
- Distal renal tubular acidosis
- Nephrolithiasis
- Shortening of the QT interval
- Corneal calcium deposition (band keratopathy)

Etiology of Hypercalcemia

- Hyperparathyroidism
 - Primary
 - Adenoma
 - Hyperplasia
 - Carcinoma
 - Other Forms
 - Familial Hypocalciuric Hypercalcemia
 - Lithium therapy
 - Tertiary hyperparathyroidism
-

Hypercalcemia

- Malignancy
 - Granulomatous Disease
 - Endocrinopathy
 - Thyrotoxicosis, adrenal insufficiency, pheochromocytoma (ectopic PTH secretion)
 - Drug induced
 - Vitamin A and D, Milk-Alkali syndrome, Thiazide diuretics
 - Immobilization
 - Paget's
-

Primary Hyperparathyroidism

- Most common cause hypercalcemia in ambulatory setting
 - Incidence 1/500
 - Women affected more often than men 3:1
 - Results from inappropriate secretion PTH by one or more glands
 - 85% cases due to single parathyroid adenoma
 - 15% cases due to hyperplasia
 - MEN I
-

Primary Hyperparathyroidism

Clinical Presentation

- Asymptomatic
 - Elevated calcium on routine labs
 - History kidney stones, unexpected fracture/osteopenia/osteoporosis
-

Primary Hyperparathyroidism

■ Evaluation/Diagnosis

- Elevated calcium and i-PTH, low or normal phosphorous
 - Alkaline phosphatase
 - “hungry bone syndrome”
 - Creatinine
 - 24 hour urine calcium/creatinine
 - Renal US
 - Bone Density
 - Sestamibi Scan (only if surgery planned)
-

Primary Hyperparathyroidism

■ Treatment

□ Surgical

■ Indication for parathyroidectomy

- 1 mg/dl above labs upper limit of normal
- Signs/symptoms hypercalcemia
- Kidney stones
- Hypercalciuria >400mg/24 hour (4mg/kg body weight)
- T score < -2.5
- Age < 50 years

■ Minimally Invasive

- PTH monitored intraoperatively
-

Primary Hyperparathyroidism

- Medical Treatment
 - Monitor
 - Hydration
 - In general calcium intake should not be restricted
 - Vitamin D supplementation
 - Newer agents
 - cinacalcet, bisphosphonates
-

Familial Hypocalciuric Hypercalcemia (FHH)

- Genetic, autosomal dominant
 - Mimics primary hyperparathyroidism
 - PTH slightly high, however inappropriate for level of calcium
 - Mutation in parathyroid calcium sensor
 - Higher setpoint
 - Low urinary calcium/creatinine <0.01
 - No end organ damage
 - No treatment required
-

Malignancy

- Most common cause of hypercalcemia in hospitalized patients
 - Due to excessive efflux of calcium from bone
 - 2 major mechanisms
 - Humoral
 - Local osteolytic hypercalcemia
 - Previously believed to be most common, only accounts for 20%
 - Release factors that directly reabsorb bone
-

Malignancy

Humoral

- ❑ Most common mechanism
- ❑ Occurs in numerous common tumors
 - Squamous cell carcinoma
 - ❑ Lung, head, neck and cervix
 - Renal, bladder, ovarian carcinoma
 - Hematological malignancies
- ❑ PTHrP
 - Squamous cell lung cancer
- ❑ 1, 25 OH-Vitamin D
 - lymphomas
- ❑ Tumor derived growth Factor
 - Multiple Myeloma

Malignancy

Treatment

- Hydration
 - Loop Diuretic
 - Bisphosphonates
 - Dialysis
-

Granulomatous Disease

- Sarcoidosis, Tuberculosis, Leprosy
 - Activation of 1 alpha hydroxylase (macrophage)
 - conversion 25-OH Vitamin D → 1, 25(OH) Vitamin D
 - PTH low
 - Treat with glucocorticoids
-

Hypocalcemia

PTH deficiency

- acquired
 - Thyroidectomy
 - Parathyroidectomy
 - Hypomagnesemia
 - Irradiation
 - Infiltrative
 - Developmental defect of parathyroid glands (DiGeorge)
 - Autosomal dominant hypocalcemia (activating mutation of calcium receptor gene)
-

Hypocalcemia

- PTH Resistance
 - Pseudohypoparathyroidism
 - Congenital defect
 - Absent metacarpal, short stature, round face, mental disability
 - Target organ unresponsiveness to PTH
 - Serum PTH levels high
-

Hypocalcemia

Vitamin D

■ Deficiency

- Nutritional deficiency and lack of skin exposure
 - Osteomalacia
 - Adult
 - Proximal muscle weakness

 - Rickets Type 1
 - Hereditary vitamin D deficiency due to lack of 1-alpha hydroxylase

 - Renal insufficiency
-

Hypocalcemia

Vitamin D

- Resistance

- Rickets Type II

- Target organ unresponsiveness to vitamin D due to defect in receptor
-

Hypocalcemia

Calcium Deposition

■ Extravascular Deposition

- Hyperphosphatemia due to tumor lysis, rhabdo, renal failure
- Pancreatitis
- “Hungry bone syndrome”

■ Intravascular deposition

- Citrate in blood transfusion
 - lactate
-

Hypocalcemia

- Treatment
 - Calcium
 - PO vs IV
 - Vitamin D
 - 25 and/or 1,25 (OH) Vitamin D
 - Magnesium
-

Thyroid

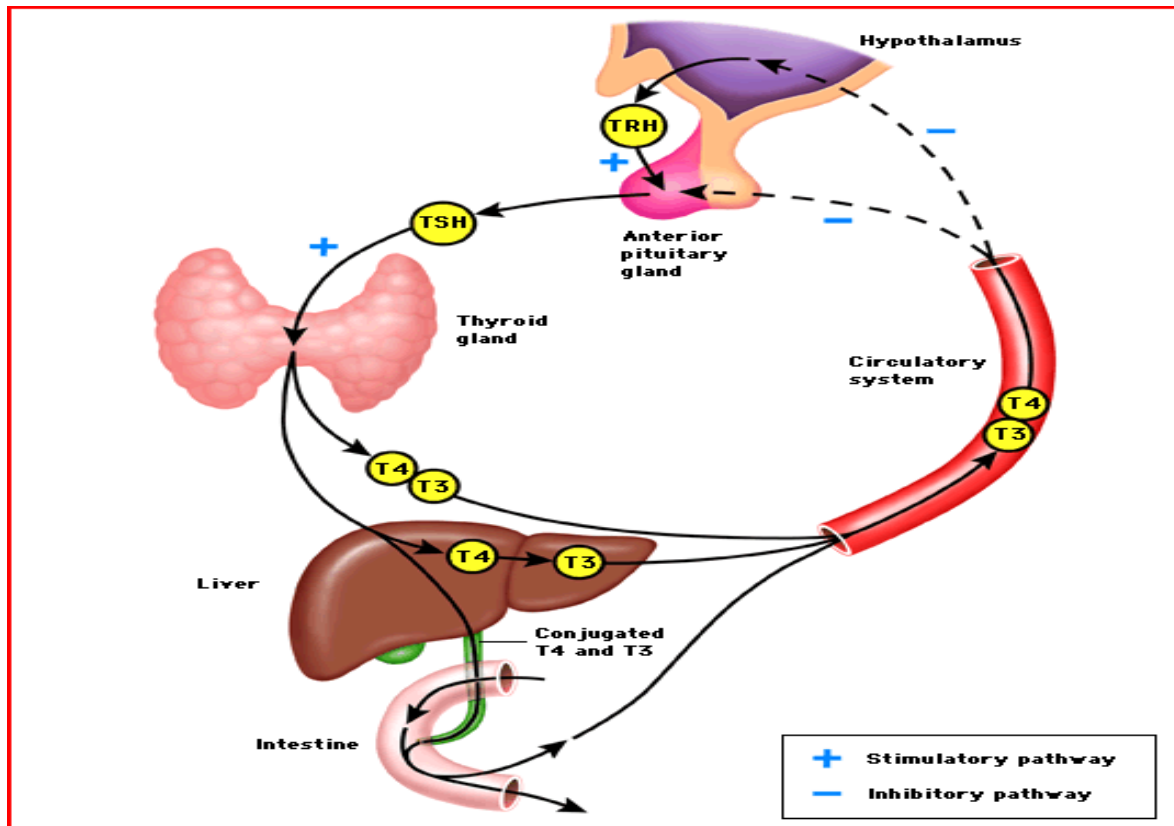
- Physiology
 - Hypothyroidism
 - Hyperthyroidism
 - Thyroid Nodules
 - Thyroid Cancer
-

Thyroid Physiology

- Under regulation of the hypothalamus (TRH) and pituitary (TSH)
 - Thyroid gland synthesizes and releases thyroid hormone
 - Thyroid consists of thyroid follicles containing thyroglobulin
 - Thyroglobulin is storage form of thyroid hormone
-

Thyroid Hormone

- T4 and to lesser extent T3 is released from thyroid gland
 - Majority T3 is produced peripherally by deiodination of T4
 - Majority T4 and T3 is bound to thyroid binding globulin (TBG) and albumin
 - T4 is bound more tightly than T3 to TBG
 - Only the free hormone is active
 - T3 has higher affinity for thyroid receptor
 - T3 is active hormone while T4 is prohormone
-

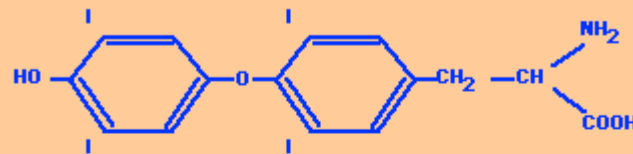


Pathways of thyroid hormone metabolism Thyrotropin-releasing hormone (TRH) increases the secretion of thyrotropin (TSH), which stimulates the synthesis and secretion of triiodothyronine (T3) and thyroxine (T4) by the thyroid gland. T3 and T4 inhibit the secretion of TSH, both directly and indirectly by suppressing the release of TRH. T4 is converted to T3 in the liver and many other tissues by the action of T4 monodeiodinases. Some T4 and T3 is conjugated with glucuronide and sulfate in the liver, excreted in the bile, and partially hydrolyzed in the intestine. Some T4 and T3 formed in the intestine may be reabsorbed. Drug interactions may occur at any of these sites.

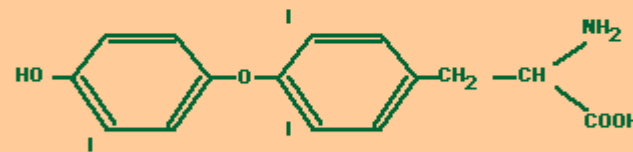
Thyroid Hormone

Structures of the Thyroid Hormones

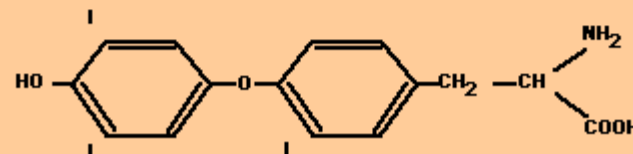
Thyroxine (T_4)



3,5,3-Triiodothyronine (T_3)



3,3,5-Triiodothyronine (rT_3)



Thyroid

- T3 uptake

- Indirect measurement of free T4
 - Constant x T3 resin Uptake x Total T4
- Inverse relationship with TBG



Thyroid

■ TBG

□ Increased

- Congenital
- Estrogen
 - Contraceptive, replacement, pregnancy
- Hypothyroidism*

□ Decreased

- Congenital
- Androgens
- Liver failure
- Nephrotic syndrome
- Malnutrition
- Hyperthyroidism*
- Sick patients
- glucocorticoids

Hypothyroidism

- Primary
 - Secondary
 - Pituitary disease
 - check free T4, TSH unreliable
 - Tertiary
 - Hypothalamic disease
 - Sarcoidosis, tumor, radiation
 - Resistance to thyroid hormone
 - Rare
 - Abnormal binding of thyroid hormone to receptor
 - High TSH and T3/T4 +/- signs hypothyroidism
-

Hypothyroidism

■ Symptoms

- ❑ Nonspecific
- ❑ Modest weight gain
- ❑ Cold intolerance
- ❑ Constipation
- ❑ Dry skin
- ❑ Fatigue
- ❑ Constipation
- ❑ Menstrual irregularities
- ❑ Muscle aches

■ Signs

- ❑ Dry skin/hair
 - ❑ Nonpitting edema
 - ❑ Thick lips or tongue
 - ❑ Slow relaxation phase of DTR (“hung up reflex”)
 - ❑ Thinning lateral aspect of eyebrows
-



Primary Hypothyroidism

- Hashimoto's
 - Most common cause hypothyroidism
 - Women>men
 - Incidence increases with age
 - Autoimmune destruction of thyroid gland
 - Associated with positive anti-TPO and/or anti-thyroglobulin antibody
 - Slowly progressive
 - May coexist with other autoimmune diseases
-

Hashimoto's

■ Labs

- TSH, Total T4 and T3 resin Uptake or free T4, and thyroid antibodies

■ Treatment

- Thyroxine replacement
 - T4 vs T3
- Subclinical hypothyroidism
 - Modestly elevated TSH with normal T4/T3
 - Indications for treatment
 - Hypercholesterolemia
 - Symptoms consistent with hypothyroidism



Factors That Increase the Requirement for T4

Pregnancy

Estrogen therapy

Weight gain

Drugs which increase catabolism of T4

- Rifampin
- Carbamazepine
- Phenytoin
- Phenobarbital
- Imatinib

Malabsorption or increased excretion of T4

- Gastrointestinal disorders
- Drugs which interfere with T4 absorption
 - Ferrous sulfate
 - Cholestyramine or colestipol
 - Sucralfate
 - Aluminum hydroxide gels
 - Calcium carbonate
 - Sertraline (?)
 - Raloxifene
- Nephrotic syndrome

Progressive thyroid dysfunction

Subacute Thyroiditis

- Often history viral illness
 - Neck tenderness
 - During recovery phase transient period hypothyroidism lasting weeks to several months
 - Usually transient
 - Positive antibodies associated with increased risk of developing primary hypothyroidism
-

Subacute Thyroiditis

■ Labs

- TSH, Total T4 and T3 resin Uptake or free T4, and thyroid antibodies
- ESR

■ Imaging

- Uptake and Scan
-

Subacute Thyroiditis

■ Treatment

□ Depending on stage

- Beta blockers
 - Anti inflammatory
 - High dose PTU (decrease peripheral conversion T4→T3)
 - Steroids
 - Thyroid hormone
-

Post Partum Hypothyroidism

- Recovery phase
 - Self limiting
 - Can reoccur with future pregnancies
 - Positive antibodies associated with increase risk of later developing permanent hypothyroidism
-

Primary Hypothyroidism (other)

- Iatrogenic/Drugs
 - Thyroidectomy
 - Radioablation
 - Anti-thyroid medications
 - Lithium, Amiodarone, Interferon
 - Frequently underlying autoimmune process
 - Iodine deficiency
 - Rare in well-developed countries
 - Dyshormonogenesis
 - Rare
 - Enzymatic defect in biosynthesis
 - Leads to hypothyroidism and goiter

Myxedema Coma

- End stage severe longstanding hypothyroidism
 - Endocrinology emergency
 - Elderly
 - Hypothermia, bradycardia, hypotension
 - Predisposing condition
 - Cold, infection, trauma, CNS depressants
-

Myxedema Coma

■ Treatment

□ Supportive care

- correction hypothermia, treat underlying illness, IV fluids with glucose

□ IV thyroid replacement

□ Corticosteroids

Treatment of Myxedema Coma

- Draw serum for T4, TSH, and cortisol.
- Administer thyroxine 200 to 400 μg (0.2 to 0.4 mg) intravenously followed by daily doses of 50 to 100 μg , and triiodothyronine 5 to 20 μg intravenously followed by 2.5 to 10 μg every 8 hours.
- Change to an equivalent oral dose of thyroxine when the patient can tolerate oral medications. (Oral dose = intravenous dose \div 0.75).
- Supportive measures:
 - Mechanical ventilation
 - Fluids and vasopressor drugs to correct hypotension
 - Passive rewarming
 - Intravenous dextrose
 - Stress-doses glucocorticoids
 - Consider empirical antibiotic treatment
 - Monitor for arrhythmias and treat when indicated

Hypothyroidism

■ Miscellaneous

- Prolactin
 - Dosing T4
 - Elderly vs young
 - Start at 25ug and titrate up
 - 1.5ug/kg body weight
 - Treat TSH within normal range
 - Exception secondary/tertiary hypothyroidism-free T4 upper end of normal
 - Consider R/O adrenal insufficiency
 - Primary vs secondary hypothyroidism
-

Hypothyroidism in Pregnancy

- Thyroid Binding Globulin (TBG) increases with pregnancy
 - Pregnant women with underlying thyroid disease often unable to increase thyroid hormone production
 - Patient given instruction as soon as pregnancy confirmed increase dose by 30%
 - Some evidence hypothyroidism in 1st trimester associated with mental disability in offspring
-

Hyperthyroidism

- Thyrotoxicosis
 - Excess thyroid hormone from any cause
 - Low TSH +/- elevated T4/T3
 - Radioactive Iodine uptake and scan helps to differentiate various forms
-

Hyperthyroidism

- Grave's Disease
 - Subacute Thyroiditis
 - Post-Partum Thyroiditis
 - Lymphocytic thyroiditis
 - Acute Thyroiditis
 - Toxic Adenoma
 - Toxic Multinodular Goiter
 - Iodine induced
 - IV contrast, iodine containing supplements
 - Factitious
 - Excess Beta HCG from molar pregnancy or choriocarcinoma
 - Struma ovarii
 - TSH producing pituitary adenoma
 - Medications
 - Amiodarone, lithium, interferon
-

Hyperthyroidism

■ Symptoms

- ❑ Palpitations
- ❑ Anxiety
- ❑ Weight loss/gain
- ❑ Polyphagia
- ❑ Heat intolerance
- ❑ Increased frequency BM
- ❑ Tremulous
- ❑ Difficulty concentrating
- ❑ Menstrual irregularities

■ Signs

- ❑ Goiter
- ❑ Thyroid bruit*
- ❑ Resting tremor
- ❑ Lid lag
- ❑ Proptosis*
- ❑ Tachycardia/atrial fibrillation
- ❑ Widened pulse pressure
- ❑ Proximal myopathy
- ❑ Neck tenderness
- ❑ Dermopathy*
- ❑ Warm/moist skin

Grave's Disease

- Most common cause hyperthyroidism (60-70%)
 - Autoimmune activation TSH receptor
 - Thyroid Stimulating Immunoglobulin
 - Familial
 - Women > Men
 - Associated with other autoimmune diseases
 - Vitiligo, Pernicious Anemia, Myasthenia Gravis, Addison's disease, T1DM
 - Anti-TPO and Anti-Thyroglobulin antibodies may also be present
-

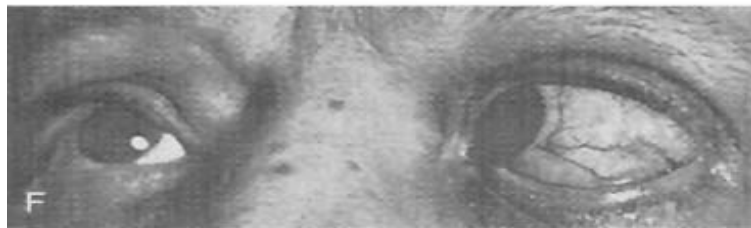
Grave's Disease

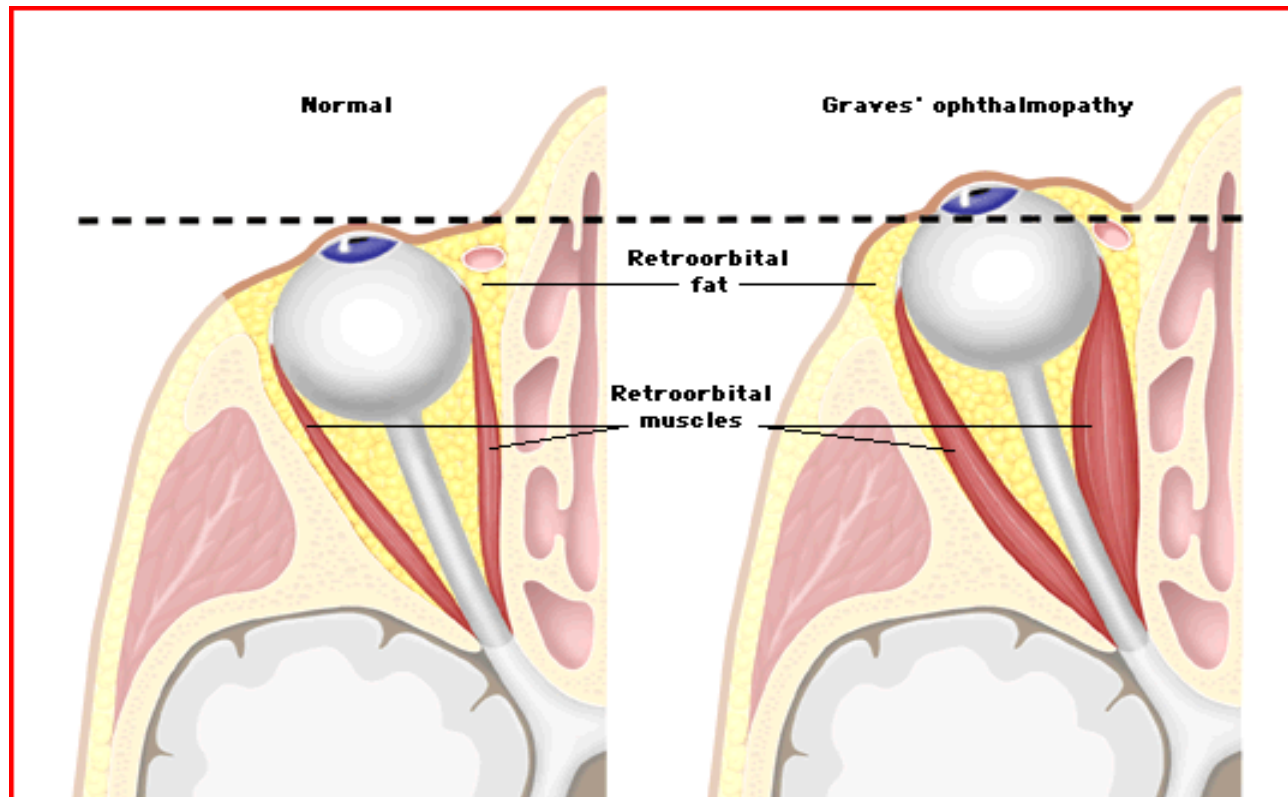
- Triad
 - Thyroid bruit, dermopathy, proptosis are all pathognomonic
 - Labs
 - Suppressed TSH, elevated T4 and/or T3, increased T3 uptake
 - Imaging
 - Uptake and scan
 - Increased, diffuse uptake
-



Infiltrative dermopathy Infiltrative dermopathy in a patient with Graves' disease showing bilateral involvement with an orange-peel appearance. Courtesy of Terry F Davies, MD, FRCP.







Graves' ophthalmopathy: Retroorbital fat and muscles Both the retroorbital fat and muscles are involved in the development of Graves' ophthalmopathy. Cytokine released from fibroblast and pre-adipocytes accentuate the secretion of hyaluronic acid-like molecules which increase the osmotic pressure in the tissues causing fluid accumulation and, in particular, distension of the muscle bundles. This figure shows the marked swelling of the retroorbital muscles, often well visualized on MRI or CT scanning in such patients. The consequence of retroorbital swelling is proptosis (exophthalmos) not well illustrated here since this may depend on both the anatomy of the orbit and the degree of swelling.

Grave's Disease

■ Treatment

□ Anti-thyroid medications

■ **PTU**

- Inhibits synthesis thyroid hormone
 - Decreases peripheral conversion T4 → T3
 - Does not block release preformed thyroid hormone
 - Side effects
 - Agranulocytosis, hepatitis, urticaria
 - 18-24 months treatment to decrease chance of relapse
 - Preferred pretreatment in surgery
-

Grave's Disease

■ Treatment

□ Anti-thyroid medication

■ **Methimazole**

- Inhibits synthesis only
- Preferred pretreatment RAI
- Same side effects as PTU
 - Cross reactivity

□ Beta Blocker

- Symptomatic relief
 - Decrease peripheral conversion $T4 \rightarrow T3$
-

Grave's Disease

■ Treatment

□ Radioactive iodine

- Exacerbation of hyperthyroidism and eye disease
- Pretreatment drug of choice is methimazole
- Hypothyroidism wanted/potential side effect

□ Iodine

- Blocks release thyroid hormone
- Wolf Chaikoff Effect (Escape)

□ Surgery

- Rarely used
 - Pretreatment indicated with PTU/Iodine
 - Major complications are hypothyroidism, hypoparathyroidism, damage to recurrent laryngeal nerve
-

Therapy	Advantages	Disadvantages
Thionamides (1-2 years)	Chance of permanent remission	Minor side effects: rash, hives, arthralgias, fever, gastrointestinal symptoms
	Avoids permanent hypothyroidism	Low risk of agranulocytosis
	Low cost	Risk of fetal goiter and hypothyroidism if pregnant Frequent visits to the physician
Radioiodine	Permanent resolution of hyperthyroidism	Permanent hypothyroidism
		Radiation precautions for several days after treatment; avoid contact with young children and pregnant women
		Rare radiation thyroiditis
Surgery	Rapid, permanent cure of hyperthyroidism	Permanent hypothyroidism
		Risk of hypoparathyroidism, recurrent laryngeal nerve damage, and general anesthesia
		High cost

Treatment of Graves' hyperthyroidism Summary of the advantages and disadvantages of the three major therapeutic modalities used in the treatment of Graves' hyperthyroidism.

Toxic Multinodular Goiter

- Accounts for 20-30% cases hyperthyroidism
 - Nodular goiter on exam
 - Milder increase in T4/T3
 - RAI uptake and Scan
 - Normal to high patchy uptake
 - RAI treatment of choice
 - Large doses of iodine may precipitate thyrotoxicosis in Non-Toxic MNG
-

Toxic Adenoma

- AKA Plummer's Disease
 - 3-5% toxic adenoma
 - Caused by solitary hyperfunctioning nodule
 - Nodule may be palpable on exam
 - Low TSH with elevated T4 and/or T3
 - RAI uptake and scan
 - Normal to high uptake
 - Solitary hot nodule
 - Remainder glands suppressed
 - RAI treatment of choice
-

Thyroiditis

- Subacute
 - Tender gland
 - Preceding viral illness
 - Lymphocytic
 - painless
 - Post-Partum
 - Weeks to several months
 - Acute
 - Extremely rare
 - Bacterial infection
-

Thyroiditis

- Self Limiting
- Hyperthyroidism → Hypothyroidism → Euthyroidism
- During hyperthyroid phase
 - Low TSH, elevated T3/T4, elevated ESR, +/- thyroid antibodies
 - RAI uptake and scan
 - No uptake
- Symptomatic relief
 - Beta-Blocker
 - High dose PTU severe cases
 - Block conversion T4 → T3
 - NSAIDS/Steroids
 - Subacute thyroiditis

Hyperthyroidism

- Iodine Induced
 - Jod Basedow
 - Underlying thyroid pathology
 - Self limiting
 - History IV contrast obtained within several weeks of onset
 - Low TSH, elevated T4, typically normal T3
 - Low RAI uptake
 - Pretreatment
 - Symptomatic relief
-

Hyperthyroidism

■ Medications

- Lithium

- Amiodarone

- Type I vs Type II

- Increased production vs destructive thyroiditis

- Often difficult to differentiate

- Treatment

- Discontinue amiodarone

- Anti-thyroid medications, iopanoic acid, steroids, beta-blocker, surgery

Hyperthyroidism

- Factitious
 - Low TSH
 - Low RAI uptake
 - Decreased thyroglobulin
 - Elevated in thyroiditis
- Molar Pregnancy and Choriocarcinoma
 - Stimulatory effect of hCG
- Struma Ovarii
 - Ectopic thyroid tissue
 - RAI uptake and scan
 - Uptake in pelvis and no uptake in neck
- TSH producing pituitary adenomas
 - Extremely rare
 - Suspect with elevated T4/T3 and normal/high TSH

Hyperthyroidism

- Apathetic Hyperthyroidism
 - Seen in the elderly
 - Thyrotoxicosis without the adrenergic manifestations
 - Appear depressed, often diagnosed with myxedema
 - Weight loss, atrial fibrillation, CHF, muscle weakness
 - Often Toxic MNG underlying disorder
-



Hyperthyroidism

■ Thyroid Storm

- Decompensated form of severe thyrotoxicosis
 - Uncommon, life threatening condition
 - Precipitating event
 - ex. Infection, trauma, surgery, DKA
 - Fever, tachycardia, neurological abnormalities, hypertension followed by cardiovascular collapse
 - Treatment
 - Anti-thyroid medications, iodine, steroids, B-blockers, control hyperthermia
-

Diagnostic Criteria for Thyroid Storm*†

Thermoregulatory dysfunction

Temperature		
99-99.9		5
100-100.9		10
101-101.9		15
102-102.9		20
103-103.9		25
≥ 104.0		30

Cardiovascular dysfunction

Tachycardia		
99-109		5
110-119		10
120-129		15
130-139		20
≥ 140		25

Central nervous system effects

Mild		10
Agitation		
Moderate		
Delirium		20
Psychosis		
Extreme lethargy		
Severe		30
Seizure		
Coma		

Congestive heart failure

Mild		5
Pedal edema		
Moderate		
Bibasilar rales		10
Severe		15
Pulmonary edema		
Atrial fibrillation		10

Gastrointestinal-hepatic dysfunction

Moderate		10
Diarrhea		
Nausea/vomiting		
Abdominal pain		
Severe		20
Unexplained jaundice		

Precipitant history

Negative		0
Positive		10

* A score of 45 or more is highly suggestive of thyroid storm; a score of 25 to 44 supports the diagnosis; and a score below 25 makes thyroid storm unlikely.

† Adapted from Burch, HB, Wartofsky, L, Endocrinol Metab Clin North Am 1993; 22:263.

Sick Euthyroid Syndrome

- Seen in critically ill patients
 - Low TSH, free T4, and T3
 - Elevated Reverse T3*
 - No treatment
-

Patterns of Thyroid Function Tests during Assessment of Thyroid Function

Serum TSH	Serum Free T4	Serum T3	Assessment
Normal hypothalamic-pituitary function			
Normal	Normal	Normal	Euthyroid
Normal	High	Normal or high	Euthyroid hyperthyroxinemia
Normal	Low	Normal or low	Euthyroid hypothyroxinemia
Normal	Low	Normal or high	Euthyroid: triiodothyronine therapy
Normal	Low normal	Normal or high	Euthyroid: thyroid extract therapy
High	Low	Normal or low	Primary hypothyroidism
High	Normal	Normal	Subclinical hypothyroidism
Low	High or normal	High	Hyperthyroidism
Low	Normal	Normal	Subclinical hyperthyroidism
Abnormal hypothalamic-pituitary function			
Normal or high	High	High	TSH-mediated hyperthyroidism
Normal or low*	Low or low-normal	Low or normal	Central hypothyroidism

* In central hypothyroidism, serum TSH may be low, normal or slightly high.

Thyroid Nodule

- Extremely common
 - Approximately 50% patients over 65 will have at least 1 thyroid nodule on US
 - Incidentaloma



Causes of Thyroid Nodules

Benign

- Multinodular (sporadic) goiter ("colloid adenoma")
- Hashimoto's (chronic lymphocytic) thyroiditis
- Cysts: colloid, simple, or hemorrhagic
- Follicular adenomas
 - Macrofollicular adenomas
 - Microfollicular or cellular adenomas
- Hurthle-cell (oxyphil-cell) adenomas
 - Macro- or microfollicular patterns

Malignant

- Papillary carcinoma
- Follicular carcinoma
 - Minimally or widely invasive
 - Oxyphilic (Hurthle-cell) type
- Medullary carcinoma
- Anaplastic carcinoma
- Primary thyroid lymphoma
- Metastatic carcinoma
 - (Breast, renal cell, others)

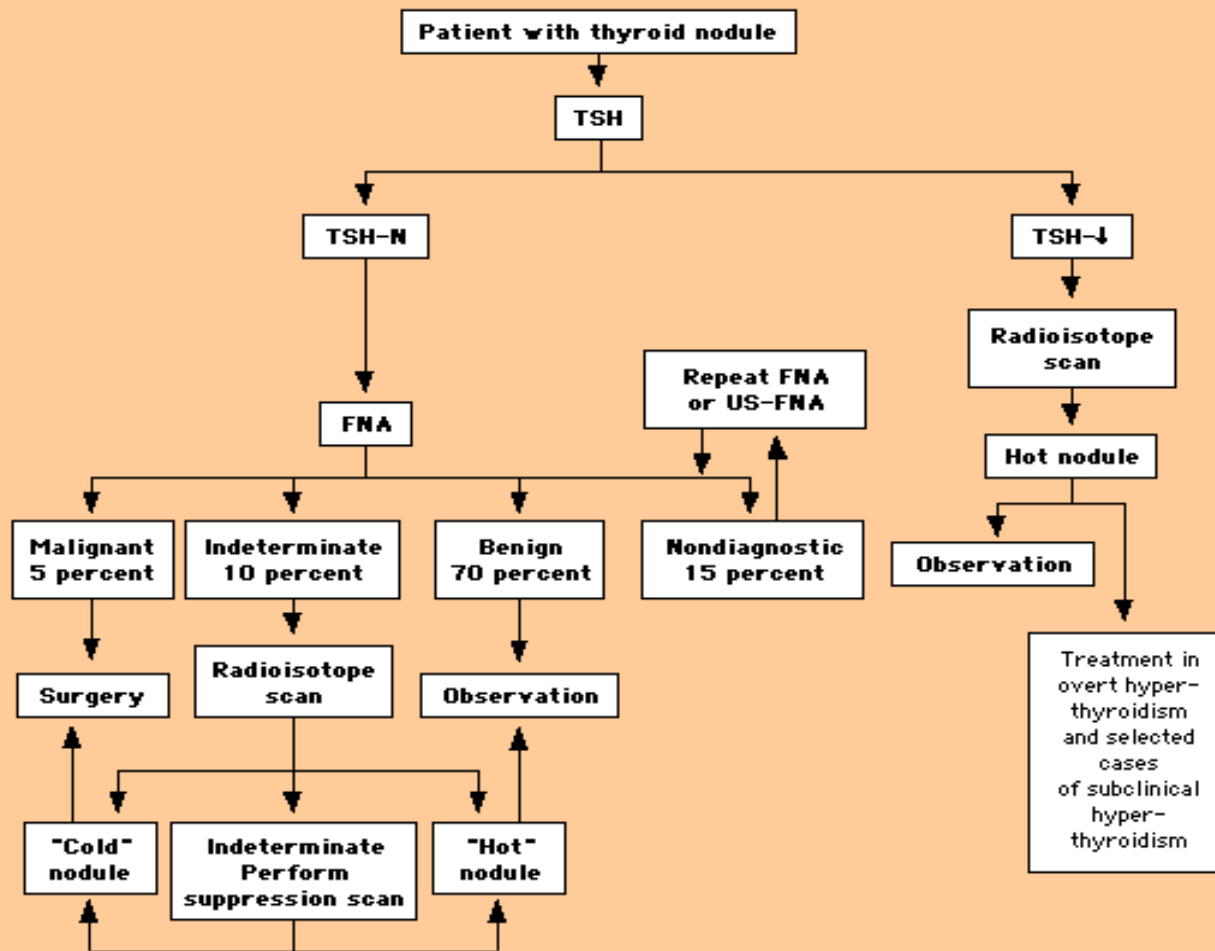
Thyroid Nodules

- Benign
 - Non toxic Goiter
 - Not associated with inflammation or neoplastic process
 - Causes
 - Majority unknown
 - Iodine deficiency
 - Iodine excess
 - Dyshormonogenesis
 - Radiation
 - Cyst
 - Adenoma
 - Thyroiditis

Thyroid Nodule

- Carcinoma
 - Papillary
 - Follicular
 - Anaplastic
 - Medullary
 - Lymphoma
 - Metastatic
-

Recommended Management of Thyroid Nodules†



FNA: Fine-needle aspiration; N: Normal; TSH: Thyroid-stimulating hormone (thyrotropin);
 US-FNA: Ultrasound-guided fine-needle aspiration.

† Modified from: Castro, MR, Gharib, H. *Endocr Pract* 2003; 9:128.

Thyroid Cancer

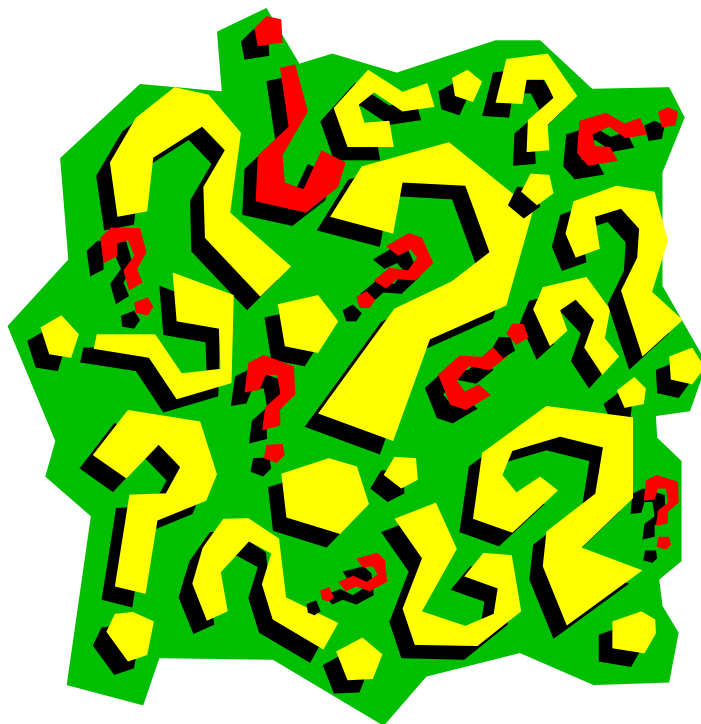
■ Treatment

- Surgery
- Radioactive iodine
- Thyroid replacement
 - Suppression TSH without overt hyperthyroidism

■ Follow Up

- Physical Exam
 - TFTs including Thyroglobulin
 - Thyrogen whole body scan
 - Ultrasound
-

THANK YOU



gillissh@aol.com

gillissh@umdnj.edu