AU InforMed

Volume 11 Number 1 (Issue 260) *Tuesday, January 1, 2013*

Guest Editors: Gina Hinel, Corrie Lowe, and Betty Jo House, Pharm. D. Candidates 2013

Key Inforbits

- Thyroid Quick Picks
- Basics of the Thyroid Gland
- Hypothyroidism: Causes, Signs and Symptoms, Diagnosis, Treatment
- Hyperthyroidism: Causes, Signs and Symptoms, Diagnosis, Treatment

January is Thyroid Awareness Month

Thyroid Quick Picks[1]

- Approximately 30 million Americans have thyroid disorder, but almost half remain undiagnosed
- Thyroid disorders are more common in women
- Fatigue is a common complaint for both hypo- and hyper- thyroid conditions
- Most thyroid diseases are life-long conditions that can be managed with medication and proper monitoring

Taken from
http://www.empoweryourhealth.org/THYROID

Basics of the Thyroid Gland[1-3]

The fundamental roles of thyroid hormones include maintaining normal growth and development in children and metabolic stability in adults. The thyroid gland is a butterfly-shaped gland located in the base of the neck. The gland makes the two thyroid hormones, inactivated thyroxine (T4) and activated triiodothyronine (T3). These thyroid hormones are secreted into the blood and transported by proteins to tissues throughout the body. Only "free" or unbound thyroid hormone is able to diffuse into the cell, elicit a biologic effect, and regulate thyroid stimulating hormone secretion from the pituitary. The gland secretes 80% of inactivated T4 and only 20% of activated T3. Most T3 is synthesized from the breakdown of T4 to T3. This conversion is necessary for proper thyroid function and mainly occurs in the liver and kidney. The production of thyroid hormone is regulated by thyroid stimulating hormone (TSH) secreted by the anterior pituitary. The secretion of TSH is under negative feedback control by the circulating level of free thyroid hormone. In addition, nutrition, non-thyroidal hormones, drugs, and illness regulate the extra-thyroidal de-iodination of T4 to T3.

Taken from http://www.empoweryourhealth.org/THYROID

References:

1. Thyroid Top Ten [Internet]. AACE;2012 [cited 2012 Nov 27]. Available from: http://www.empoweryourhealth.org/thyroid-top-ten
2. Jonklaas J, Talbert RL. Thyroid Disorders. In: DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM, editors. Pharmacotherapy: A pathophysiologic approach. 8th ed. New York: McGraw-Hill Medical; c2011. p. 1303-1328.
3. Thyroid Function Tests [Internet]. American Thyroid Association;2012 [cited 2012 Nov 26]. Available from: www.thyroid.org

Disorders of the thyroid gland are classified into two disease states, hypo- and hyper- thyroidism.

Hypothyroidism

Hypothyroidism is an endocrine disorder in which the thyroid gland does not produce enough thyroid hormone and is most commonly seen in women and people over the age of 50.[1-2]

Causes[1,2]

Hypothyroidism can be caused by a number of common factors including:

- Hashimoto's disease (autoimmune disorder)
- Treatment of hyperthyroidism
- Radiation therapy
- Thyroid surgery
- Medications (i.e. lithium and amiodarone)
- Pregnancy

In the past, iodine deficiency was once considered a common source of hypothyroidism; however, the implementation of iodinated salt has greatly reduced this cause within the U.S. population.

Signs and Symptoms[1-2]

Signs and symptoms (s/s) of hypothyroidism vary widely depending on the severity and duration of thyroid hormone deficiency. In most patients, s/s of hypothyroidism take years to develop. The first symptoms of hypothyroidism include fatigue or a sluggish feeling which often go unnoticed by the patient or attributed to older age. However, as time progresses the patient's metabolism will continue to decline and more pronounced s/s begin to develop. The following depiction to the left visually lists common s/s of hypothyroidism.

Taken from ***http://www.nursinged.com/***

The most common s/s of hypothyroidism include:

- Unexplained weight gain
- Thin, brittle hair or nails
- Fatigue or weakness
- Heavier menstrual periods
- Paleness or dry skin
- Depression
- Cold intolerance
- Constipation

Diagnosis[1]

The diagnosis of hypothyroidism is dependent upon signs and symptoms, free T4 measurements, thyroid antibodies, and serum TSH levels utilized as the primary screening test. Upon diagnosis, hypothyroidism can be classified into three categories including:

- ***Primary hypothyroidism***: Dysfunction is present at the thyroid gland; therefore, labs would show an increase in TSH levels and a low free T4 level.
- ***Subclinical hypothyroidism***: Dysfunction is present at the thyroid gland, but there is not enough decrease in thyroid hormone to illicit signs and symptoms. Labs would indicate a low TSH level, but normal free T4 levels.
- ***Secondary hypothyroidism***: Dysfunction is occurring at a location other than the thyroid gland, such as the pituitary gland; therefore, labs would show a low TSH and free T4 level.

Treatment Options[3]

Thyroid supplementation is the current treatment option for patients with hypothyroidism. The course of therapy is patient specific with the cause of hypothyroidism, TSH levels, and free T4 levels dictating treatment.

Current guidelines recommend that treatment of hypothyroidism is best accomplished with synthetic levothyroxine (eg, Synthroid). Dosing of medication is dependent upon age, sex, and body size. Young healthy adults with hypothyroidism may be started on full replacement doses (1.6 µg/kg) initially with the

goal of achieving euthyroid levels earlier. However, patients with subclinical hypothyroidism only require doses of 25-75 µg to achieve euthyroid levels. Sequential dose adjustments of 12.5 -25 µg should be guided by TSH levels taken every 4 to 8 weeks until euthyroid levels are achieved. Once an adequate replacement dose has been established, periodic follow-up levels should be obtained every 6 to 12 months for monitoring purposes.

Once euthyroid levels are achieved, metabolic symptoms such as fatigue, weakness, constipation, depression, and others will subside within weeks. However, other clinical manifestations such as skin and hair changes may take up to 3 to 6 months to resolve.

Alternative therapies for the treatment of hypothyroidism and include the following:

Liotrix	T4/T3	• More adverse effects (cardiotoxicity) and expensive
Dessicated Thyroid	T4/T3	• Natural product and least expensive • More adverse reactions and hypersensitivity reactions
Liothyronine	T3	• Not necessary to convert T4 to T3 • Most adverse effects (cardiotoxicity) and expensive

Synthetic and natural thyroid hormones are only FDA approved for the treatment of hypothyroidism and should not be used for other purposes.

References:

1. Hypothyroidism (underactive thyroid) [Internet]. Mayo Foundation for Medical Education and Research (MFMER);2010 June 10 [cited 2012 Nov 26]. Available from: http://www.mayoclinic.com/health/hypothyroidism/DS00353
2. Dugdale DC, Topiwala S, Zieve D. Hypothyroidism [Internet]. Bethesda (MD): National Center for Biotechnology Information, U.S. National Library of Medicine; 2012 June 4 [cited 2012 Nov 26]. Available from: http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001393/
3. Garber JR, Cobin RH, Gharib H, Hennessey JV, Klein I, Mechanick JI, Pessah-Pollack R, Singer PA, Woeber KA. Clinical Practice Guidelines for Hypothyroidism in Adults: Cosponsored by the American Association of Clinical Endocrinologists and the American Thyroid Association. Endocrin Pract. 2012 Sept 11;18(5):1-207.

Hyperthyroidism

Hyperthyroidism is an endocrine disorder in which the thyroid gland produces an excess of thyroid hormone over an acute or chronic time period.[1-2]

Causes[1-3]

Hyperthyroidism can be caused by a number of different factors including:

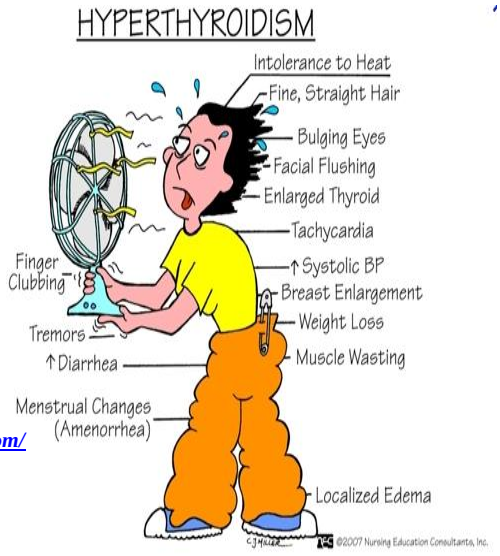
- Grave's disease (autoimmune disorder)
- Hyperfunctioning thyroid nodules (toxic adenoma, multinodular goiter)
- Thyrotoxicosis (including: thyroiditis and ingestion of large amounts of thyroid hormone)

Signs and Symptoms[1-3]

Signs and symptoms (s/s) of hyperthyroidism closely relate to its role in homeostasis. Initially, many individuals have an increase in energy or the symptoms may be mistaken as nervousness. Over time, the body becomes weakened and fatigued with muscle weakness being common.

The following depiction to the right visually lists some of the s/s of hyperthyroidism. Not depicted is the development of atrial fibrillation which can be a result so hyperthyroidism.

In addition, a common sign associated specifically with Grave's disease is exophthalmos, defined as bulging of the eyes out of their orbits.



Taken from http://www.nursinged.com/

Diagnosis[1-4]

A physical exam may reveal signs and symptoms indicative of hyperthyroidism. Additionally, blood tests measuring the levels of the thyroid hormone aid in confirming the diagnosis and include the following subtypes of hyperthyroidism:

- ***Primary hyperthyroidism:*** Labs would show low serum TSH and elevated free T3 and T4.
- ***Subclinical hyperthyroidism***: Labs would show low serum TSH and normal free T3 and T4; often without any signs or symptoms.

Additional tests may be required to determine the specific cause of hyperthyroidism.

Treatment Options[1,2,5]

The best management strategy depends on multiple factors including age, physical condition, and the severity of the disorder. Options for treatment including the following:

Radioactive iodine	• Oral radioactive iodine is prescribed in an effort to stop the production of excess thyroid hormone by ablating the thyroid gland • Symptom improvement occurs within 3 to 6 months
Anti-thyroid agents (methimazole or propylthiouracil)	• Medications work by preventing the thyroid gland from producing an excess of thyroid hormone • Symptom improvement occurs within 6 to 12 weeks • Methimazole is generally recommended by the guidelines over propylthiouracil except in select situations
Beta-blockers	• Agents are utilized to treat symptomatic hyperthyroidism, such as a rapid heart rate, anxiety, and preventing palpitations • Considered adjunctive therapy
Thyroidectomy	• Surgery to remove the thyroid is an option in those patients who are not candidates or do not prefer other treatment options

References:

1. Hyperthyroidism (overactive thyroid) [Internet]. Mayo Foundation for Medical Education and Research (MFMER);2012 Nov 20 [cited 2012 Nov 27]. Available from: http://www.mayoclinic.com/health/hyperthyroidism/DS00344
2. Topiwala S, Zieve D. Hyperthyroidism [Internet]. Bethesda (MD): National Center for Biotechnology Information, U.S. National Library of Medicine; 2012 June 4 [cited 2012 Nov 27]. Available from: http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001396/
3. Hyperthyroidism. [pdf]. American Thyroid Association. [cited 2012 Nov 27]. c2012. Available from http://www.thyroid.org/wp-content/uploads/patients/brochures/Hyper_brochure.pdf
4. Dong BJ, Schneider EF. Thyroid Disorders. In: Koda-Kimble MA, Young LY, Aldredge BK, Corelli RL, Ernst ME, Guglielmo BJ, Jacobson PA, Kradjan WA, Williams BR, editors. Applied Therapeutics: The clinical use of drugs. 10th Edition. Philadelphia: Lippincott Williams & Wilkins; c2009. p1186-1222.
5. Bahn RS, Burch HB, Cooper DS, Garber JR, Greenlee MC, Klein I, Laurber P, McDougall R, Montori VM, Rivkees SA, Ross DS, Sosa JA, Stan MN. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. ATA/AACE Guidelines. *Endocr Pract.* 2011;17(3):e1-e65.

For more information:

- American Thyroid Association: http://www.thyroid.org/
- AACE and ATA Professional Guidelines: http://thyroidguidelines.net
- AACE Thyroid Awareness: http://www.thyroidawareness.com/

The last "dose" …

"Avoid fruits and nuts. You are what you eat" ~Jim Davis

An electronic bulletin of drug and health-related news highlights, a service of …
Auburn University, Harrison School of Pharmacy, Drug Information Center
• Phone 334-844-4400 • Fax 334-844-8366 • http://www.pharmacy.auburn.edu/dilrc/dilrc.htm
Bernie R. Olin, Pharm.D., Director
Archived issues are available at: http://pharmacy.auburn.edu/dilrc/au_informed.htm