

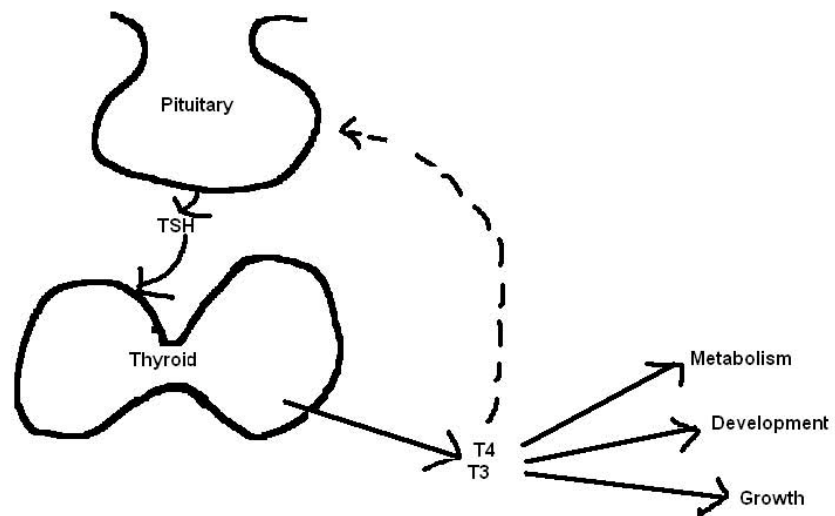
HYPERTHYROIDISM

This booklet describes hyperthyroidism, the tests that may be used to diagnose and treat hyperthyroidism, and the various treatment choices that will be discussed with you.

WHAT IS THE THYROID GLAND?

The thyroid gland is a butterfly-shaped structure that is located in the neck in front of the windpipe. When the thyroid gland enlarges, it can be felt (and sometimes seen) on either side of the throat, especially when a person swallows. The thyroid gland makes two hormones - thyroxine (T4) and triiodothyronine (T3). The thyroid hormones are important for several reasons: 1) Thyroid hormones affect body metabolism, or the way the body uses food for heat production and energy; 2) Thyroid hormones are necessary for proper growth in children; 3) Thyroid hormones are required for the proper development of the brain during infancy; and 4) Thyroid hormones affect the heart's performance.

The thyroid gland produces the thyroid hormones under the direction and regulation of another hormone, thyroid stimulating hormone or TSH. The TSH is made by a gland in the brain called the pituitary. When the pituitary gland thinks the body needs more thyroid hormones, it releases TSH which stimulates the thyroid gland to make the thyroid hormones. When the pituitary gland the body has plenty of thyroid hormones, it slows down the release of TSH, and this then reduces the amount of thyroid hormones made by the thyroid gland. If this sounds complicated, think of the thyroid gland as the furnace in your house, and the pituitary gland as the thermostat that senses the room temperature and controls the heat production of your furnace.



WHAT IS HYPERTHYROIDISM?

Hyperthyroidism is a state in which thyroid hormones are overproduced. In hyperthyroidism, the T3 and T4 levels are too high. This overproduction of thyroid hormones causes weight loss, rapid heart rate, muscle weakness, increased sweating, intolerance of heat, sleep disturbances, irritability, moodiness, increased bowel movements, menstrual irregularity, and rapid speech. If allowed to progress, it may result in heart failure.

WHAT IS GRAVES' DISEASE?

Graves' Disease is the most common cause of hyperthyroidism and is usually associated with an enlarged thyroid gland, prominent eyes, and muscle weakness. It was first described by Dr. R.J. Graves in 1835.

WHAT CAUSES GRAVES' DISEASE?

Graves' Disease is caused by an abnormality in the immune system. (This is explained in the section below.) Often this abnormality affects more than

one member in an extended family; this suggests that there may be an inherited tendency for some people to get Graves' Disease.

Immune system problems: All healthy people have the ability to make antibodies to germs when they get sick. Antibodies recognize the germs as being foreign and act like "Packman" by gobbling up the germs and destroying them. But, sometimes the body gets confused and makes antibodies that look upon the thyroid gland as if it were a foreign germ. Some of these antibodies stimulate the thyroid gland; they're called thyroid stimulating immunoglobulins (TSI). Some of the antibodies destroy the thyroid gland as if it were a germ; these are called ATA or anti-thyroid antibodies. Other antibodies block the normal production of the thyroid gland; these are called thyroid-blocking inhibitory immunoglobulins or TBI.

The severity of Graves' Disease depends on which of these "confused" antibodies is being made. The body also may make antibodies to the muscles behind the eyes. This leads to an inflammation of the eye muscles and causes the muscles to swell and push the eye forward.

Once a child or adult develops Graves' Disease, the immune system abnormality is present for life. There may be periods of rest when the disease is inactive (remission), and there may be other times when the disease is reactivated (relapse). At the present time, there are no treatments that will cure this immune system abnormality.

The immune system abnormality is usually just limited to antibodies that affect the thyroid gland and the eye muscles. The rest of the immune system is all right, and it is able to make normal antibodies that fight infection.

Graves' Disease can begin anytime during life. Graves' Disease, at different stages of life, is discussed below.

NEWBORN HYPERTHYROIDISM

Infants born to mothers who have Graves' Disease may be exposed during pregnancy to thyroid-stimulating antibodies (TSI) that cross the placenta.

These antibodies produce hyperthyroidism in the baby by crossing the placenta and stimulating the baby's thyroid. These infants may be born small and have weak muscles, rapid heart rate, fever, jaundice, breathing problems, enlarged thyroid glands, and prominent eyes. It may progress to irritability, feeding difficulty, sweating, weight loss, and frequent bowel movements. Newborn hyperthyroidism usually needs to be evaluated and treated promptly with medication to normalize the thyroid hormone levels. Fortunately, this type of hyperthyroidism usually resolves in 4-12 weeks when the mother's thyroid stimulating antibodies disappear from the baby's blood. Once this resolves, it is unlikely to recur.

ACQUIRED HYPERTHYROIDISM

Older children can develop hyperthyroidism for reasons that are not entirely understood. Girls are affected much more frequently than boys. Refer to the explanation of antibodies (above) to understand how older children develop hyperthyroidism.

OTHER CAUSES OF HYPERTHYROIDISM

Hyperthyroidism also can develop if a person eats food that is contaminated by thyroid hormones, or if a person takes in excessive amounts of iodine. People who normally take thyroid hormone medication to treat **HYPOT**hyroidism (underactivity of the thyroid gland) can develop signs of **HYPERT**hyroidism if they take too much thyroid medicine. Occasionally, benign (noncancerous) thyroid tumors and, occasionally, a short, intense infection or inflammation of the thyroid gland can cause hyperthyroidism.

WHAT TESTS ARE COMMONLY USED TO DIAGNOSE HYPERTHYROIDISM?

Hyperthyroidism usually is easily diagnosed by learning about the child's symptoms and by giving the child a thorough physical examination. The tests that are explained below are used to judge the severity of the disease.

BLOOD TESTS

Thyroid hormone levels: The blood test may measure different forms of thyroid hormone - T4, T3 uptake, T3, Free T4 and TSH.

TSI - thyroid stimulating immunoglobulins - used to detect Graves' Disease in newborns.

THYROID IMAGING

To estimate the size and shape of the internal parts of the thyroid gland, your child's doctor may order thyroid imaging tests. Your child may receive radioactive iodine orally or another radioactive substance through an IV (**thyroid scan**). These radioactive substances are concentrated in the thyroid gland, making it visible to the scanner. A picture is then taken which represents the size of the thyroid gland and locates obvious abnormalities. A **technetium scan** can be performed shortly after the child takes the medicine. With the **radioiodine scan**, there is a time lag between when the child takes the medicine and when the scan can be done.

PREGNANCY TESTS

Pregnancy tests are done routinely before thyroid scans are performed. This is because the radioactive substances used for scanning can cross the placenta and harm the baby.

WHY TREAT HYPERTHYROIDISM?

Hyperthyroidism requires treatment to prevent dangerous weight loss, to prevent heart disease that can develop, to restore normal muscle tone and strength, and to prevent death.

HOW IS HYPERTHYROIDISM TREATED?

Several treatment options are available. The endocrinologist will discuss each option with you, pointing out the advantages and disadvantages of each treatment option. Be sure to ask plenty of questions until you feel you thoroughly understand all the options.

MEDICATION

Propylthiouracil (PTU) or Methimazole can be taken orally several times a day to treat hyperthyroidism. These two medications block the thyroid gland's ability to make the thyroid hormones. Of the various treatment options available, these medications are the only option that does not destroy the thyroid gland. This treatment is generally safe and highly effective. However, there are some problems connected with taking PTU or Methimazole.

1. These medicines must be taken several times a day for at least two years.

2. The relapse rate is high; that is, in 60-75% of cases, the hyperthyroidism may come back after the medications are stopped.

3. There are possible side effects - skin rash (5% of cases), joint pains, liver problems, and agranulocytosis (not enough white blood cells to fight infections). Agranulocytosis is the most serious complication, and it occurs in about 5:1000 of people taking these medications. If a child taking either of these medications develops a persistent sore throat and fever, the medications are stopped and antibiotics are given. These complications are usually reversible when the medications are stopped but, occasionally, the outcome may be fatal.

NOTE: Regardless of the therapy option chosen, all children are **first** treated with one of these medications to normalize the thyroid hormone levels in the body.

Radioactive Iodine THERAPY

Using radioactive iodine, a nuclear medicine specialist destroys the overactive thyroid gland. First the child is treated with the anti-thyroid medication, then a test is done to determine the thyroid's uptake of radio-iodine and a scan is done to calculate the dose needed to destroy the thyroid

gland. Finally, the radio-iodine is swallowed and the thyroid gland deteriorates.

The advantage of this treatment option is that it provides a relatively easy solution to the problem of having hyperthyroidism without the risk associated with having surgery.

Potential problems that should be considered are:

1. Although radioactive iodine has been the preferred treatment in adults for a long time, pediatric endocrinologists used to be hesitant about using this treatment in children. This was because we did not have any long-term experience using radioactive iodine in children, and we worried that children might be prone to developing cancer in the remaining thyroid tissue. Now, after 30 years of using radioactive iodine in children, we have follow-up information from children treated at the Cleveland Clinic; those individuals who were treated as children with radioactive iodine for hyperthyroidism have had no increased occurrence of thyroid cancer. Similar follow-up information from Sweden also has confirmed that there is **no** increased occurrence of thyroid cancer in individuals treated with radioactive iodine therapy. Thus, our previous worries about the safety of radioactive iodine therapy in children seem to have been unfounded.
2. There also was a theoretical concern about the possible association between radioactive iodine therapy and the development of leukemia, a cancer of the blood. Information from adults treated with radioactive iodine, as well as from children treated over the last 30 years has **not** revealed any increased occurrence of leukemia.
3. There was concern that radioactive iodine might affect the testicles and ovaries of children, leading to malformations in their future children. These worries also have been unfounded; there has **not** been any increased occurrence of birth defects in the babies of adults treated as children with radioactive iodine. However, we must caution that if radioactive iodine is taken during pregnancy, there may be serious problems in the baby. Therefore, it is routine to perform a pregnancy test in all females before giving radioactive iodine therapy.

NOTE: These risks may be discussed with the nuclear medicine specialist before you sign consent for this treatment option. You are encouraged to ask questions.

4. The thyroid gland usually is destroyed totally by radioactive iodine treatment. Then the body cannot make thyroid hormone, and the person must take life-long daily thyroid medicine (pills). This eventually occurs in almost all patients.

SURGERY

The overactive lobe(s) of the thyroid gland can be removed surgically following a few weeks of taking the anti-thyroid medications listed above. The advantage of surgical treatment is that it offers a relatively quick solution to the problem of having hyperthyroidism, i.e., there are no long-term medication schedules to follow. However, there are problems connected with this option.

1. Surgery requires several days in the hospital and is uncomfortable. Excessive bleeding, infection, and paralysis of the vocal cords can occur with thyroid surgery. Also, other glands that are located in the neck (parathyroid glands) can be damaged leading to problems with calcium regulation. One of these problems may occur in 1% of cases.
2. It is quite likely that too much of the thyroid gland will be removed, and thyroid hormone tablets will have to be taken daily for life.
3. If too little thyroid glandular tissue is taken out, you will again need to consider the treatment choices: radioactive iodine therapy, repeat surgery (difficult), and medication.

OTHER MEDICINE THAT MAY BE PRESCRIBED

To control the rapid heart rate and high blood pressure that may be present, your child's doctor may prescribe propranolol [Inderal] or atenolol [Tenormin] for a brief period of time. This medicine should not be taken by

children with asthma; please tell your doctor if your child has ever had wheezing episodes. It is important not to exercise while taking propranolol, as this may strain the heart.

OTHER PROBLEMS ASSOCIATED WITH HYPERTHYROIDISM

WEIGHT CHANGES

When hyperthyroidism is untreated, the body's metabolic rate is very high. During this period, a person can eat an incredible amount of food and usually not gain weight. However, once treatment for the hyperthyroidism has begun and the blood thyroid levels return to normal, the body's metabolic rate decreases. If the person continues to eat voraciously, rapid weight gain occurs. This can be quite a problem, especially for adolescents. You may want to meet with our dietitian before and during treatment of the hyperthyroidism to learn ways of coping with this change in body metabolism.

SCHOOL PROBLEMS

Children with hyperthyroidism cannot concentrate on schoolwork, and their irritability can interfere with normal student-to-student and student-to-teacher relationships. We suggest you talk with your child's teacher and school nurse about the effects that hyperthyroidism has on children's behavior. Explain to the school personnel that, with proper treatment, your child's thyroid levels will return to normal and that his/her behavior also will improve.

EYE PROBLEMS

If the hyperthyroidism has caused the eyes to bulge, the eyelids may not close completely. To keep the eyes moist during sleep, you may need to put lubricating eye drops in your child's eyes at bedtime. None of the treatment options listed above cures the eye disease. However, the bulging eye problem may eventually resolve.

FOLLOWUP

The thyroid gland may eventually "burn out" and stop making thyroid hormone. For this reason, your child will need to be checked every year for signs of **HYP**Othyroidism. When your child is an adult, he/she will need to see an adult doctor for this yearly checkup.

GRAVES' DISEASE AND PREGNANCY

Because of the effects of Graves' Disease on you and your baby, we recommend that you plan your pregnancy and talk things over with your endocrinologist before you become pregnant. In addition to your usual obstetric care with your obstetrician, you will need to be monitored by your endocrinologist throughout the pregnancy. Even if you no longer have your thyroid gland because it was destroyed by radioactive iodine or surgery, you will still need to be cared for by your endocrinologist because your immune system may continue making TSI that can cross the placenta and affect your baby's thyroid. If you are treated properly during your pregnancy, you can ensure your well-being and that of your baby.