



WHAT IS THE THYROID GLAND?

The thyroid gland is a butterfly-shaped endocrine gland that is normally located in the lower front of the neck. The thyroid's job is to make thyroid hormones, which are secreted into the blood and then carried to every tissue in the body. Thyroid hormone helps the body use energy, stay warm and keep the brain, heart, muscles, and other organs working as they should.

HOW YOU CAN HELP

A tax-deductible contribution to the American Thyroid Association supports valuable patient education and crucial thyroid research. New discoveries and better understanding will translate into improved ways to prevent, diagnose, and treat thyroid disease. Give online at www.thyroid.org.

CANCER OF THE THYROID

Thyroid cancer is rare compared to other cancers. In the United States in 2010 an estimated 45,000 patients were diagnosed with thyroid cancer compared to over 200,000 patients with breast cancer and 140,000 patients with colon cancer. However, fewer than 2000 patients die of thyroid cancer each year. In 2008 when statistics were last collected, over 450,000 patients were alive and living with thyroid cancer. Thyroid cancer is usually very treatable and is often cured with surgery (see *Thyroid Surgery brochure*) and, if indicated, radioactive iodine (see *Radioactive Iodine brochure*). Even when thyroid cancer is more advanced, effective and well-tolerated treatment is available for the most common forms of thyroid cancer. It is interesting that the number of individuals - both men and women - with newly diagnosed thyroid cancer is increasing at a rate faster than for other types of cancer. The reason for this is unclear. Even though the diagnosis of cancer is terrifying, the outlook for patients with thyroid cancer is usually excellent.

SYMPTOMS

WHAT ARE THE SYMPTOMS OF THYROID CANCER?

Thyroid cancer often arises in a lump or nodule in the thyroid and does not cause any symptoms (see *Thyroid Nodule brochure*). Lab tests generally do not help to find thyroid cancer. Thyroid tests such as TSH are usually normal even when a cancer is present. The best way to find a thyroid cancer is to make sure that your thyroid gland does not have nodules and is not enlarged. Neck examination by your doctor is the best way to do that. Often, thyroid nodules are discovered incidentally on imaging tests like CT scans and neck ultrasound done for completely unrelated reasons. Occasionally, patients themselves find thyroid nodules by noticing a lump in their neck while looking in a mirror, buttoning their collar, or fastening a necklace. Rarely, thyroid cancers and nodules do cause symptoms. In these cases, patients may complain of pain in the neck, jaw, or ear. If a nodule is large enough to compress the windpipe or esophagus, it may cause difficulty with breathing, swallowing, or cause a "tickle in the throat". Even less commonly, hoarseness can be caused if a cancer invades the nerve that controls the vocal cords.

The important points to remember are that cancers arising in thyroid nodules generally do not cause symptoms, thyroid tests are typically normal even when cancer is present, and the best way to find a thyroid nodule is to make sure your doctor checks your neck!

CAUSES

WHAT CAUSES THYROID CANCER?

Thyroid cancer is more common in people who have a history of exposure to high doses of radiation, have a family history of thyroid cancer, and are older than 40 years of age. However, for most patients, we do not know the specific reason why thyroid cancers develop.

High dose radiation exposure, especially during childhood, increases the risk of developing thyroid cancer in susceptible patients. Prior to the 1960s X-ray treatments were often used for conditions such as acne, inflamed tonsils, adenoids, lymph nodes, or to treat enlargement of a gland in the chest called the thymus. All these treatments have been associated with an increased risk of developing thyroid cancer later in life. Even X-ray therapy used to treat serious cancers such as Hodgkin's disease (cancer of the lymph nodes) or breast cancer has been associated with an increased risk for developing thyroid cancer if the treatment included exposure to the head, neck or chest. Routine X-ray exposure such as dental X-rays, chest X-rays, mammograms have not been shown to cause thyroid cancer.

Thyroid cancer can also be caused by radioactive iodine released during nuclear disasters such as the 1986 accident at the Chernobyl power plant in Russia or the 2011 nuclear disaster in Fukushima, Japan related to the tsunami. Children are usually the most affected and often develop cancers within a few years of exposure. However, even adults exposed during these accidents develop thyroid cancer with increased frequency, sometimes as many as 40 years later.

You can be protected from developing thyroid cancer in the event of a nuclear disaster by taking potassium iodide (see *Nuclear Radiation and the Thyroid brochure*). This prevents the absorption of radioactive iodine and has been demonstrated to reduce the risk of thyroid cancer. The American Thyroid Association recommends that anyone living within 200 miles of a nuclear accident be given potassium iodide. If you live in a state containing a nuclear reactor and want more information about potassium iodide, check the recommendations from your state at the following link: http://www.thyroid.org/professionals/publications/statements/ki/02_04_09_ki_states.html.

DIAGNOSIS

HOW IS THYROID CANCER DIAGNOSED?

A diagnosis of thyroid cancer is usually made by a fine needle aspiration biopsy of a thyroid nodule or after the nodule is removed during surgery (see *Thyroid Nodule brochure*). Although thyroid nodules are very common, less than 1 in 10 harbors a thyroid cancer.

WHAT ARE THE TYPES OF THYROID CANCER?

Papillary thyroid cancer. Papillary thyroid cancer is the most common type, making up about 70% to 80% of all thyroid cancers. Papillary thyroid cancer can occur at any age. Papillary cancer tends to grow slowly and often spreads to lymph nodes in the neck. However, unlike many other cancers, papillary cancer has a generally excellent outlook even if there is spread to the lymph nodes.

Follicular thyroid cancer. Follicular thyroid cancer, which makes up about 10% to 15% of all thyroid cancers in the United States, tends to occur in somewhat older patients than does papillary cancer. As with papillary cancer, follicular cancer first can spread to lymph nodes in the neck. Follicular cancer is also more likely than papillary cancer to grow into blood vessels and from there to spread to distant areas, particularly the lungs and bones.

Medullary thyroid cancer. Medullary thyroid cancer, which accounts for 5% to 10% of all thyroid cancers, is more likely to run in families and be associated with other endocrine problems. In family members of an affected person, a test for a genetic mutation in the RET proto-oncogene can lead to an early diagnosis of medullary thyroid cancer and, subsequently, curative surgery to remove it.

Anaplastic thyroid cancer. Anaplastic thyroid cancer is the most advanced and aggressive thyroid cancer and is the least likely to respond to treatment. Fortunately, anaplastic thyroid cancer is rare and found in less than 2% of patients with thyroid cancer.

Thyroid Cancer

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TREATMENT

WHAT IS THE TREATMENT FOR THYROID CANCER?

Surgery. The primary therapy for all forms of thyroid cancer is surgery (see Thyroid Surgery brochure). The generally accepted approach at the present time is to remove the entire thyroid gland in what is called a total thyroidectomy. Some patients will have thyroid cancer present in the lymph nodes of the neck or upper chest. These lymph nodes are removed at the time of thyroid surgery or sometimes, as a later procedure. After surgery, patients need to be on thyroid hormone for the rest of their life (see *Thyroid Hormone Treatment brochure*). Often, thyroid cancer is cured by surgery alone, especially if the cancer is small. If the cancer is larger, if it has spread to lymph nodes or if your doctor feels that you are at high risk for recurrent cancer, radioactive iodine may be used to destroy any remaining thyroid cancer cells after the thyroid gland is removed. Please read the *Thyroid Surgery brochure* to learn more details about the risks and benefits of surgery, and what kind of recovery can be expected.

Radioactive iodine therapy. Thyroid cells and most thyroid cancers absorb and concentrate iodine very readily. That is why radioactive iodine can be used so effectively to destroy all remaining normal and cancerous thyroid tissue after thyroidectomy (see *Radioactive Iodine brochure*). The procedure to destroy or ablate thyroid tissue is called a radioactive iodine ablation. This produces high concentrations of radioactive iodine in thyroid tissues damaging the DNA in the thyroid cells, eventually causing the cells to die. Since other tissues in the body do not efficiently absorb or concentrate iodine, radioactive iodine used during the ablation procedure has little or no effect on tissues outside of the thyroid. Two risks are known to happen. In some patients, the radioactive iodine can affect the glands that produce saliva and lead to a having a dry mouth. In other patients, when high dose of radioactive iodine are necessary, there may be a small risk of developing other cancers later. These risks are small but increase as the doses of radioactive iodine increase. The potential risks of treatment can be minimized by using the smallest dose possible. Balancing potential risks against the benefits of radioactive iodine therapy is an important discussion that you should have with your doctor if radioactive iodine therapy is recommended.

If your doctor recommends radioactive iodine therapy, your TSH will need to be elevated prior to the treatment. This can be done in two ways. The first is by stopping to take thyroid hormone pill (levothyroxine) for 4-6 weeks. This causes you to become hypothyroid and high levels of TSH will be produced by your body naturally. However, hypothyroidism causes fatigue that can sometimes be significant. To minimize the symptoms of hypothyroidism your doctor may prescribe T3 (Cytomel®, liothyronine) which is a short acting form of thyroid hormone that is usually taken after the levothyroxine is stopped until the final 2 weeks before treatment. Alternatively, TSH can be increased sufficiently without making you hypothyroid simply by injecting TSH into you! Recombinant human TSH (rhTSH, Thyrogen®) can be given as two injections in the several days prior to

radioactive iodine treatment. The benefit of this approach is that you can stay on thyroid hormone and do not become hypothyroid. You may also be asked to go on a low iodine diet for 1 to 2 weeks prior to treatment (see *Low Iodine Diet FAQ*). This will leave your body iodine depleted which improves absorption of radioactive iodine, and helps maximize the treatment effect.

Once the TSH level is high enough, a pretherapy iodine scan is often done by administering a small dose of radioactive iodine. This scan determines how much thyroid tissue needs to be destroyed and allows the doctor to calculate how large a dose of therapeutic radioactive iodine needs to be administered. When used correctly, radioactive iodine therapy has proven to be safe and well-tolerated and it has even been able to cure cases of thyroid cancer that have spread to other parts of the body like the lungs.

Treatment of Advanced Thyroid Cancer. Thyroid cancer that spreads (metastasizes) to distant locations in the body occurs rarely but can be a serious problem. Surgery and radioactive iodine remain the best way to treat such cancers as long as these treatments continue to work. However, for more advanced cancers, or when radioactive iodine therapy is no longer effective, other means of treatment are needed. External beam radiation directs precisely focused X-rays to areas that need to be treated—often metastases to bones or other organs. This can kill or slow the growth of specific tumors. Cancer that has spread more widely requires additional treatment. New chemotherapy agents that have shown promise treating other advanced cancers are increasingly available for treatment of thyroid cancer. These drugs rarely cure advanced cancers that have spread widely throughout the body. However, they can often slow down or partially reverse the growth of the cancer. These treatments are usually given by an oncologist (cancer specialist) and often require care at a regional or university medical center.

WHAT IS THE FOLLOW-UP FOR PATIENTS WITH THYROID CANCER?

Periodic follow-up examinations are essential for all patients with thyroid cancer because the thyroid cancer can return—sometimes many years after successful initial treatment. These follow-up visits include a careful history and physical examination, with particular attention to the neck area. Neck ultrasound is also a very important tool to visualize the inside of the neck and look for nodules, lumps or cancerous lymph nodes that might indicate the cancer has recurred. Blood tests are also important for thyroid cancer patients. All patients who have undergone thyroidectomy require thyroid hormone replacement with levothyroxine once the thyroid is removed (see *Thyroid Hormone Treatment brochure*). The dose of levothyroxine prescribed by your doctor will in part be determined by the extent of your thyroid cancer. More extensive cancers require higher doses of levothyroxine to suppress TSH. In cases of minimal or very low risk cancers, it's safe to keep TSH in the normal range. The TSH level is the most sensitive indicator of whether the levothyroxine dose is correctly adjusted and should be followed regularly by your doctor.

Another very important blood test is measurement of thyroglobulin. Thyroglobulin is a protein produced by thyroid tissue and most types of thyroid cancer and is usually checked at least once annually. Following thyroidectomy and radioactive iodine ablation, thyroglobulin levels should be undetectable for life. Therefore, a detectable thyroglobulin level should raise a suspicion for possible cancer recurrence. Detectable thyroglobulin levels may require additional tests and possible further treatment with radioactive iodine and surgery. Thyroglobulin is generally measured either when you're on thyroid hormone with a low or normal TSH, or after TSH is elevated either by stopping thyroid hormone for 3-6 weeks, or after injection of Thyrogen® (see section on radioactive iodine therapy above). Measurement of thyroglobulin may not be possible in up to 25% of patients who have interfering thyroglobulin antibodies present in their blood. In these patients, other means of follow up are often used.

In addition to routine blood tests, your doctor may want to periodically repeat a whole-body iodine scan to determine if any thyroid cells remain. Whole body scanning is also done after your TSH level is raised, either by stopping your thyroid hormone or by administering Thyrogen® injections. Increasingly, these scans are only done for high risk patients and have been largely replaced by routine neck ultrasound and thyroglobulin measurements that have a higher diagnostic sensitivity especially when done together.

WHAT IS THE PROGNOSIS OF THYROID CANCER?

Overall, the prognosis of thyroid cancer is excellent especially for patients younger than 45 years of age and those with small cancers. Patients with papillary thyroid cancer who have a primary tumor that is confined to the thyroid gland have an excellent outlook. 10 year survival for such patients is 100% and death from thyroid cancer anytime thereafter is extremely rare. For patients over 45 years of age, or those with larger or more aggressive tumors, the prognosis remains very good but the risk of cancer recurrence is higher. The prognosis is not quite as good in patients whose cancer cannot be completely removed with surgery or destroyed with radioactive iodine treatment. Nonetheless, these patients often are able to live a long time and continue to feel well despite the fact that they continue to live with cancer. It is important to talk to your doctor about your individual profile of cancer and expected prognosis. It will be necessary to have lifelong monitoring, even after successful treatment.



FURTHER INFORMATION

Further details on this and other thyroid-related topics are available in the patient information section on the American Thyroid Association website at www.thyroid.org.

