Bulletin #57

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Thyroid Ablation for Benign Thyroid Diseases

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Thyroid diseases may be grouped into structural, functional, and neoplastic categories. The treatment for each grouping varies depending on the severity of the disease and the symptoms suffered. Structural disease refers to benign nodular disease which causes gross enlargement and deformity of the thyroid gland. This enlargement creates symptoms by compressing adjacent structures and displacing normal anatomic structures such as the esophagus and windpipe.

Commonly experienced symptoms include difficulty with swallowing, choking, shortness of breath, exercise intolerance, and hoarseness. Pressure sensation within the neck is often caused by compression of the veins in the neck by the thyroid mass. When these symptoms become problematic, then surgical removal of all or half of the enlarged gland has been the standard therapeutic solution.

Patients with autonomous (overactive) nodules can experience the symptoms of hyperthyroidism – including rapid heart rate, heart palpitations, weight loss, insomnia and frequent bowel movements – in addition to the above symptoms. Autonomous nodules have typically been treated with surgical removal or radioactive iodine (RAI) that specifically targets the autonomous nodule.

The Evolution of Treatment Options

Over the past 20 years, new technologies for soft tissue destruction have evolved which limit surgical recovery and potential complications. Novel energy sources which produce heat have been modified to allow for application using thin probes. These probes are placed through pinhole skin incisions and into the targeted tissue using live image ultrasound or radiographic (CT) guidance. The original application of thermal energy using glass fibers would direct laser energy into the middle of a lesion. Thermal energy radiating from the tip of the laser fiber altered cellular proteins sufficiently to devitalize the tissue. As the devitalized tissue was slowly resorbed the nodules decreased in size, and symptoms improved. Intense heat from the laser energy can cause damage to adjacent structures, so treatments were intentionally limited to avoid complications. However, significant symptom relief was achieved with effective nodule volume reduction which occurs within weeks after the treatment.

Today, alternative energy sources such as radiofrequency and microwave allow for improved safety and precise energy application to optimize ablation in thyroid nodules of all shapes. The results of these treatments were slightly better than laser treatments, and larger irregularly shaped lesions could be treated. Thyroid nodule treatment

using these three modalities for treatment for benign disease became very common in Asia and Europe decades before FDA approval in the United States.

In the fall of 2019, RFA ablation of soft tissue was approved and thyroid ablation was introduced by interventional radiologists, endocrinologists, endocrine surgeons, and otolaryngologists. The successful results of the treatments in the United States mirrored the Asian and European experience. The safety and effectiveness of this treatment was recognized quickly, and major organizations (including the American Association of Endocrine Surgeons, American Thyroid Association, American Association of Otolaryngology-Head and Neck Society, Society of Interventional Radiology, North American Society for Interventional Thyroidology) endorsed this treatment as an alternative to thyroid surgery in appropriate circumstances.

This nonsurgical treatment has been sought after by patients worldwide hoping to relieve symptoms, retain their thyroid gland, and avoid the potential risks of surgery.

Thyroid Ablation: Which Patients Are Good Candidates?

The typical patient that is offered thyroid ablation is someone with a large (over 3 cm) thyroid nodule that is causing symptoms. The symptoms typically include pressure, foreign body sensation, mass effect (compression of nearby structures), difficulty with swallowing, and a dry cough. The nodules can be large enough to cause symptoms of choking and airway compression. These symptoms are often worse when lying flat in bed when the patient is trying to sleep. Sleep apnea is commonly aggravated by the airway compression.

The appropriate evaluation includes thyroid ultrasound measurements and two biopsies of the larger nodule to ensure that cancer is not a possibility. Altering any tissue with thermal ablation will obscure nodule imaging features and subsequent biopsy results making definitive diagnosis difficult. Therefore, it is essential to obtain biopsies in advance of ablation. If an indeterminate pathology result prevents the cytopathologist from ruling out cancer as a potential cause of the nodule, then surgery is recommended. Molecular and genetic testing of thyroid tissue is also available to further classify the nodule for the potential of malignancy. Surgery and removal of the suspicious lesion ensures that any potentially harmful tissue is eliminated and studied for definitive pathological results. Nodule location and proximity relative to vital structures such as the trachea is also evaluated with thyroid ultrasound. Lesions close to the underlying nerves that control the voice, and the carotid arteries can decrease ablation effectiveness as compared to surgery.

Thyroid Ablation: An In-Office Procedure

Once the patient is considered a candidate for thyroid ablation, the procedure is performed as an in-office procedure. Lying flat on the back with the neck extended, local anesthesia is injected into the anterior neck tissue and then around the surface of the thyroid lobe with the problematic nodule. After effective anesthesia, a specially designed probe with circulating ice water is directed into the deepest part of the nodule. The controlled temperature application optimizes heat dissipation from the tip of the probe and facilitates safe and precise ablation. The heat radiates within the nodule in 7-10 mm

area to denature the tissue. The treatment proceeds sequentially in adjacent segments until the entire nodule is ablated. The larger nodules have more zones for treatment, thereby making the treatment time longer and energy application higher. Tissue denatured by thermal energy becomes nonviable and is eventually resorbed by the body.

After The Procedure

After radiofrequency ablation and microwave ablation, the treated thyroid tissue is expected to shrink in volume by 40 percent in one month, and about 60 percent in three months. Nodules which have been successfully treated with complete or near complete ablation will continue to shrink up to 85-90% over several years. The visible and palpable nodule eventually becomes unnoticeable, all without an operation. Nodules which retain viable segments from incomplete ablation will have limited reduction in volume and could even regrow over time. The larger nodules tend to retain more viability after treatment as do nodules which hide deep to the collar bone. Studies demonstrate that nodules over 20 ml in size may typically require two treatments to optimize the volume reduction. Additionally, complete nodule ablation has been demonstrated to reduce future nodule regrowth and reduces the potential for repeat thyroid ablation and surgery. Care is taken to not use the energy too close to critical structures and only treat the thyroid nodule. Performance under local anesthesia allows the treating physician to listen to the patient voice to directly assess the function of the critical nerves deep to the thyroid. The safety measures with thermal ablation allow for a complication rate which is much lower than an operative procedure performed under general anesthesia.

Selecting a Physician: Experience is Key

Physicians offering this intervention should be exceptionally experienced not only with performing thyroid ultrasound, but also with ultrasound guided procedures such as fine needle aspiration biopsies. The more experienced the provider, the more likely the outcome will be favorable. The results of the procedure are determined months and years later when the nodule is studied with ultrasound for viability and volume reduction. Volume reduction, associated with symptom improvement, is optimized by complete tissue ablation, best accomplished by an experienced provider.

Post-Treatment Monitoring

After the treatment the patient is monitored for nodule volume reduction with an in-office ultrasound. Usually, the thyroid nodule measurements and volume calculations are taken at one, three, and six month intervals. In general, thyroid function rarely changes, so testing for thyroid function is now optional depending upon patient symptoms.

Thyroid Ablation for Overactive Nodules

The ablation of over-active nodules is very effective in restoring normal thyroid function. In these patients, thyroid function is retested in 1 month after ablation. Most patients with an autonomous (toxic) thyroid nodule can be euthyroid by the second month after ablation and have discontinued thyroid suppressive medications immediately after the ablation. The paradigm for the management of hyperthyroidism associated with autonomous nodules has completely changed since thyroid ablation has proven so effective and safe. Patients' symptoms from this disease are quickly relieved with one treatment lasting less than an

hour. Ablation is not associated with hypothyroidism commonly caused by radioactive iodine in over 60% of patients treated for overactive nodules. This radioactive ablation had been the most common alternative to surgical removal for the management of autonomous nodules. Patients undergoing radiofrequency ablation do not require medications to replace thyroid function. Success rates have led to optimism that thermal ablation may become the primary recommendation to address this common problem.

Benefits of Thyroid Ablation

Since FDA approval in 2019, successful thyroid ablation has been performed as an alternative to thousands of thyroid operations. The patients undergoing ablation realize the advantages of both maintaining thyroid function and achieving symptomatic relief without a major operation. Symptoms of compression and tightness are improved after the first month and are forgotten by the third month. Additional benefits include improvement in swallowing and singing. Exercise is better tolerated. Physician visits become celebrations of symptomatic improvement rather than screening for further nodule enlargement. Thyroid ablation has permanently transformed the options for benign nodular disease from organ removal to organ preservation.

Looking to the Future: Potential Application for Thyroid Cancer and Autoimmune Thyroid Disease

Opportunities for clinical reporting and comparative studies will expose new paradigms for nonsurgical management of other thyroid conditions including malignant disease and autoimmune mediated thyroid gland dysfunction. Studies of these conditions will be critical to compare thyroid ablation outcomes to traditional therapies. Over time we may be favoring nonsurgical to surgical outcomes as morbidity comparisons and quality of life studies reveal both improved subjective outcomes and also acceptable pathologic responses.

To learn more about the potential use of thyroid ablation for Graves' disease, please refer to Bulletin #58 "Treatment of Graves' Disease – New and Emerging Options".

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