american thyroid association

Clinical Thyroidology for the Public

VOLUME 8 • ISSUE 12 • DECEMBER 2015

www.thyroid.org

A publication of the American Thyroid Association

AMERICAN THYROID ASSOCIATION
FOUNDED 1923
www.thyroid.org

CLINICAL **THYROIDOLOGY** FOR THE **PUBLIC**
A publication of the American Thyroid Association
VOLUME 8 • ISSUE 12 • DECEMBER 2015

EDITOR'S COMMENTS

Happy holidays and welcome to another issue of *Clinical Thyroidology for the Public*. In this journal, we will bring to you the most up-to-date, cutting edge thyroid research. We will be providing summaries of research studies that were discussed in a recent issue of *Clinical Thyroidology*, a publication of the American Thyroid Association for physicians. These summaries are present in lay language to allow the rapid dissemination of thyroid research to the widest possible audience. This means that you are getting the latest information on thyroid research and treatment almost as soon as your physicians. As always, we are happy to entertain any suggestions to improve *Clinical Thyroidology for the Public* so let us know what you want to see.

We also provide even faster updates of late-breaking thyroid news through Twitter at @thyroidfriends and on Facebook. Our goal is to provide patients with the tools to be the most informed thyroid patient in the waiting room.

Also check out our friends in the Alliance for Thyroid Patient Education. The Alliance member groups consist of: the *American Thyroid Association*, *Bite Me Cancer*, the *Graves' Disease and Thyroid Foundation*, the *Light of Life Foundation*, *ThyCa: Thyroid Cancer Survivors Association*, *Thyroid Cancer Canada and Thyroid Federation International*.

December is Thyroid and Development Awareness Month.

In this issue, the studies ask the following questions:

1. How safe is thyroid surgery?
2. Does Lithium affect thyroid function?
3. Does alcohol consumption affect your risk of getting thyroid cancer?
4. Does the risk of getting thyroid cancer change as we age?
5. Can CT scan measurements help the evaluation of thyroid nodules found incidentally on PET/CT scans done for a non-thyroid reason?
6. Is the drug Dabrafenib helpful in treating patients with radioactive iodine-resistant thyroid cancer?

We welcome your feedback and suggestions. Let us know what you want to see in this publication. I hope you find these summaries interesting and informative.

— Alan P. Farwell, MD, FACE

Follow us on Facebook Follow us on Twitter

CLINICAL **THYROIDOLOGY** FOR THE **PUBLIC**

A publication of the American Thyroid Association

AMERICAN THYROID ASSOCIATION
FOUNDED 1923
www.thyroid.org

THYROID SURGERY

Thyroid surgery is usually a safe operation and associated with a low rate of complications

BACKGROUND

Thyroid surgery is a common operation and may be recommended for several disorders, including thyroid enlargement, hyperthyroidism and thyroid cancer. Complications can include injury to the parathyroid glands (located close to the thyroid gland) and/or the nerves that are associated with voice, and as is the case with all medical procedures, rarely death. Reassuringly, all of these are usually very rare in patients undergoing thyroid surgery. This study was done to analyze the rates of various complications and death in all patients who underwent thyroid surgery within a hospitalized setting in California (U.S.) over a 15-year period.

THE FULL ARTICLE TITLE

Weiss A et al. Outcomes of thyroidectomy from a large California state database. Am J Surg. 2015 Sep 28 (ePub ahead of print)

SUMMARY OF THE STUDY

This study analyzed the data captured in the California Office of Statewide Planning and Development Patient Discharge Database which records information regarding all hospitalized patients in the state, for the period between 1995-2010. The researchers studied the 106,773 patients who had undergone a thyroid surgery in this timeframe. This group had an average age of 50 years and were 61% women and 44% non-Hispanic Whites. The entire thyroid was removed (total thyroidectomy) in 40% of the patients, with the remaining patients undergoing thyroid procedures that removed less than the whole thyroid gland (partial thyroidectomy). One-third of the patients had received thyroid surgery for a thyroid cancer. Patients tended to have other common medical conditions, such as high blood pressure, obesity, chronic obstructive pulmonary disease, and cigarette smoking.

Approximately 9% of patients experienced some complication of thyroid surgery, which included both temporary and permanent types of complications. Specifically, low blood calcium levels (hypocalcemia), usually resulting from injury to the nearby parathyroid glands, occurred in 4.5% of patients, vocal cord problems in 1.1%, requirement for a blood transfusion in 0.9%, wound infection in 0.4%, and death in 0.3%. Although the average length hospitalization was one day among all patients, 41% needed to stay hospitalized for more than two days. Patients who were older tended to have a higher risk of complications, while patients who had thyroid surgery done at hospitals that perform more than 100 thyroid surgeries per year and patients who had less than their entire thyroid removed (partial thyroidectomy) were at the lowest risk.

WHAT ARE THE IMPLICATIONS OF THIS STUDY?

This study confirms other data from studies of patients across the U.S. Using a large group of patient data collected over 15 years, the findings overall show that thyroid surgery is usually a safe procedure and associated with only rare complications, including death. The database includes all patients who were hospitalized for thyroid surgery in California during this time period, thus represents a very rigorous type of data analysis. The findings from this study will be helpful in the joint decision between patients and their physicians in discussing the pros and cons of thyroid surgery.

— Angela M. Leung, MD, MSc

ATA THYROID BROCHURE LINKS

Thyroid Surgery: http://www.thyroid.org/thyroid-surgery/

ABBREVIATIONS & DEFINITIONS

Hyperthyroidism: a condition where the thyroid gland is overactive and produces too much thyroid hormone. Hyperthyroidism may be treated with antithyroid meds (Methimazole, Propylthiouracil), radioactive iodine or surgery.

AMERICAN THYROID ASSOCIATION
FOUNDED 1923
www.thyroid.org

THYROID SURGERY, continued

Hypocalcemia: low calcium levels in the blood, a complication from thyroid surgery that is usually short-term and relatively easily treated with calcium pills. If left untreated, low calcium may be associated with muscle twitching or cramping and, if severe, can cause seizures and/or heart problems.

Parathyroid glands: usually four small glands located around the thyroid that secrete parathyroid hormone (PTH) which regulates the body's calcium levels.

Thyroidectomy: surgery to remove the entire thyroid gland. When the entire thyroid is removed it is termed a total thyroidectomy. When less is removed, such as in removal of a lobe, it is termed a partial thyroidectomy.

Thyroid Awareness Monthly Campaigns

The ATA will be highlighting a distinct thyroid disorder each month and a portion of the sales for Bravelets™ will be donated to the ATA. The month of December is **Thyroid and Development Awareness Month** and a bracelet is available through the ATA Marketplace to support thyroid cancer awareness and education related to thyroid disease.

CLINICAL **THYROIDOLOGY** FOR THE **PUBLIC**

A publication of the American Thyroid Association

AMERICAN THYROID ASSOCIATION
FOUNDED 1923
www.thyroid.org

HYPOTHYROIDISM

Lithium use is associated with an increased risk of hypothyroidism

BACKGROUND

Many drugs can affect thyroid function. One in particular, Lithium, has been associated with developing goiter, hypothyroidism and hyperthyroidism. Lithium is a medication commonly used for the treatment of mood disorders including bipolar disorder. It has been shown to protect against both depression and mania, and to decrease the risk of suicide. Up to this day it remains a key treatment for this condition because other available therapies have significant side effects and many are not recommended for use in young women. In addition to the thyroid effects, there are many reports linking the use of lithium to kidney and parathyroid gland problems. Since there is an estimated 350 million individuals worldwide that are affected by mood disorders, there is, then, a large group of patients that have taken or will take lithium in their lifetime.

This study was done in order to determine how strong is the association of the use of lithium with developing problems with the kidney, thyroid and parathyroid glands. Prior studies had left many questions not answered because they were too short in duration and therefore not able to determine what was the long term risk. The goal of this study was to determine the incidence of kidney, thyroid and parathyroid dysfunction associated with lithium use.

THE FULL ARTICLE TITLE

Shine B et al. Long-term effects of lithium on renal, thyroid, and parathyroid function: a retrospective analysis of laboratory data. Lancet 2015;386:461-68.

SUMMARY OF THE STUDY

This study was done in the UK using laboratory data available from the Oxford University Hospitals National Health Service for patients that received care from 1982 to 2014. Patients with available blood lithium levels (at least 2 measurements were required) were compared to patients who had no blood lithium levels measured. The comparison was done in regards to thyroid, kidney and parathyroid function. Hypothyroidism was defined as having a TSH level > 5.5 mIU/L and hyperthyroidism as having a TSH of <0.2 mIU/L.

A total of 4678 patients had lithium levels available for analysis; they were compared to the 689,228 patients who did not. After accounting for other variables that could have an impact on the results such as age, sex, and the presence of diabetes, the use of lithium was associated with an increased risk of hypothyroidism, but not of hyperthyroidism. Most problems appeared to occur early during the treatment and among those who had higher blood lithium levels. Younger women (<60 years old) were the most commonly affected.

The strength of this study is the use of a large database form a single health system going back 20 years. The weakness of the study is that there were no available data regarding dose, compliance or the use of other medications that could also independently affect thyroid function.

WHAT ARE THE IMPLICATIONS OF THIS STUDY?

The conclusion of this study is that the use of lithium is associated with an increased risk of developing hypothyroidism, especially in younger women. This is important for patients because mood disorders are relatively common and lithium is still widely used to treat them. The authors suggest that patients, especially young women, should be monitored for thyroid function problems when they are managed with lithium. Although this is not a recommendation stated in the current guidelines of the American Thyroid Association, consideration might be given to certain patients who are at a higher risk, such as those who have a strong family history or who have a goiter prior to start treatment.

— Jessie Block-Galarza, MD

ATA THYROID BROCHURE LINKS

Hypothyroidism: http://www.thyroid.org/hypothyroidism/

Thyroid Function Tests: http://www.thyroid.org/thyroid-function-tests/

HYPOTHYROIDISM, continued

ABBREVIATIONS & DEFINITIONS

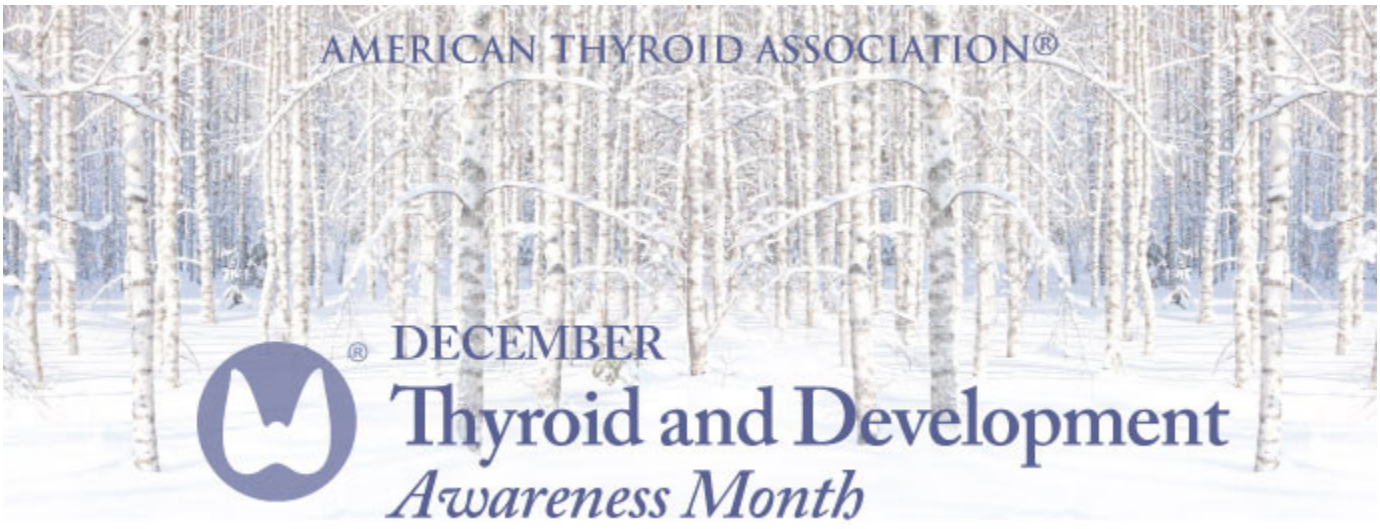
Hypothyroidism: a condition where the thyroid gland is underactive and doesn't produce enough thyroid hormone. Treatment requires taking thyroid hormone pills.

TSH: thyroid stimulating hormone — produced by the pituitary gland that regulates thyroid function; also the best screening test to determine if the thyroid is functioning normally.

Goiter: a thyroid gland that is enlarged for any reason is called a goiter. A goiter can be seen when the thyroid is overactive, underactive or functioning normally. If there are nodules in the goiter it is called a nodular goiter; if there is more than one nodule it is called a multinodular goiter

Parathyroid glands: usually four small glands located around the thyroid that secrete parathyroid hormone (PTH) which regulates the body's calcium levels.

Lithium: a medication commonly used for the treatment of mood disorders including bipolar disorder.



AMERICAN THYROID ASSOCIATION
FOUNDED 1923
www.thyroid.org

THYROID CANCER

Moderate alcohol use may be associated with lower risk of thyroid cancer

BACKGROUND

The number of cases of thyroid cancer has been increasing. The reasons for this increase is unclear. The known risks for getting this cancer include a family history of thyroid cancer and previous exposure to head and neck area radiation. However, most patients have neither of these risk factors. Interestingly, some preliminary studies have shown a lower risk of this cancer in individuals with moderate alcohol use, suggesting that alcohol may offer a protective effort on thyroid cancer. This study was done to see whether alcohol use is associated with a lower risk of thyroid cancer as had been shown in some previous studies.

THE FULL ARTICLE TITLE

Sen A et al . Baseline and lifetime alcohol consumption and risk of differentiated thyroid carcinoma in the EPIC study. Br J Cancer 2015;113:840-7. Epub August 27, 2015.

SUMMARY OF THE STUDY

This study was done in Europe at 23 centers. It was done over 18 years (1992 to 2010) and had nearly 500,000 participants. Data was collected and reviewed regarding alcohol use, health, educational level and thyroid cancer diagnosed during the study period. Average lifetime alcohol intake was calculated using weighted averages of intakes at each age. Baseline and average lifetime alcohol consumption were categorized as 0, 0.1 to 4.9 grams, 5 to 14.9 grams and ≥15 grams daily, with consumption of 0.1 to 4.9 grams/day used as the reference group. A small glass of wine or a can of beer contains about 10 grams of alcohol. The majority (70%) of the study participants were women.

Alcohol consumers were more likely to have smoked. They also had higher education levels and were more physically active. Participants who had used more than 15 grams of alcohol every day were found to have a lower risk for thyroid cancer. Overall, wine consumption on average of 10 grams every day was associated with a lower cancer risk. Similar trend was, however, not seen with beer or distilled spirits.

WHAT ARE THE IMPLICATIONS OF THIS STUDY?

The study concluded that moderate alcohol use (1–2 glasses of wine daily) may be associated with a lower risk for thyroid cancer. A similar effect was not seen with beer or distilled spirits. The cause of this association is not known. Importantly, other known risk factors were not studied, so this protective effect may not be solely due to alcohol use. Further, it is important to note that alcohol consumption has been linked to a higher risk for many other cancers such as head and neck, breast and colon cancer. Further studies are needed to better understand whether the observed protective effect of moderate alcohol consumption in thyroid cancer risk is real and, if so, why.

—Vibhavasu Sharma, MD

ATA THYROID BROCHURE LINKS

Thyroid cancer: http://www.thyroid.org/thyroid-cancer/

ABBREVIATIONS & DEFINITIONS

Alcohol consumption: a small glass of wine or a can of beer contains about 10 grams of alcohol.

CLINICAL **THYROIDOLOGY** FOR THE **PUBLIC**

A publication of the American Thyroid Association

AMERICAN THYROID ASSOCIATION
FOUNDED 1923
www.thyroid.org

THYROID CANCER

Thyroid nodules in older patients are less likely to be cancers but those that are cancers may be more aggressive

BACKGROUND

Thyroid nodules are abnormal growths of thyroid cells that form lumps within the thyroid gland. Thyroid nodules occur in up to 50% of people and are more common in the older population. The risk of a nodule being a thyroid cancer is ~5-8% overall, although some studies suggest the risk is higher in young people. However, more data are needed to determine the risk of cancer in thyroid nodules in older patients. The aim of this study was to determine the impact of patient age on the formation of thyroid nodules and on the risk that these nodules may prove cancerous.

THE FULL ARTICLE TITLE

Kwong N et al. The influence of patient age on thyroid nodule formation, multinodularity, and thyroid cancer risk. J Clin Endocrinol Metab. October 14, 2015 [Epub ahead of print].

SUMMARY OF THE STUDY

A total of 6391 patients (ages 20-95) who were evaluated at the Brigham and Women's Hospital Thyroid Nodule Clinic between 1995 and 2011 were included in the study. The patients were grouped into six age groups (20-29, 30-39, 40-49, 50-59, 60-69, ≥70 years old). All these patients had a thyroid ultrasound and a thyroid biopsy was performed in all solid thyroid nodules >1cm.

The study found that the oldest group (≥70 years old) had 43% more thyroid nodules than the youngest group (20-29 years old). Additionally, the oldest group had a 30% higher risk of having multiple thyroid nodules as compared to the youngest group. During this 16-year period, 16% of patients (1018) were diagnosed with thyroid cancer. The youngest group of patients had a 14.8% risk of cancer per thyroid nodule at diagnosis, while the oldest group had a 5.6% risk of cancer per nodule. However, the number of high-risk thyroid cancer significantly increased with advancing age, ranging from 0% in the youngest group to 16% in the oldest group.

WHAT ARE THE IMPLICATIONS OF THIS STUDY?

This study showed that older patients have more thyroid nodules >1cm, but the risk that these nodules are cancerous decreases with age. However, when thyroid cancer is found in older patients, it is more likely that these are high risk cancers. The results of this study suggest that even though thyroid nodules are more common in older patients, they should be carefully evaluated in order to detect thyroid cancers that may be aggressive.

— Maria Papaleontiou, MD

ATA THYROID BROCHURE LINKS

Thyroid Nodules: http://www.thyroid.org/thyroid-nodules/

Thyroid Disease in the Older Patient: http://www.thyroid.org/thyroid-disease-older-patient/

ABBREVIATIONS & DEFINITIONS

Thyroid nodule: an abnormal growth of thyroid cells that forms a lump within the thyroid. While most thyroid nodules are non-cancerous (Benign), ~5-8% are cancerous.

Thyroid Ultrasound: a common imaging test used to evaluate the structure of the thyroid gland. Ultrasound uses soundwaves to create a picture of the structure of the thyroid gland and accurately identify and characterize nodules within the thyroid. Ultrasound is also frequently used to guide the needle into a nodule during a thyroid nodule biopsy.

Thyroid fine needle aspiration biopsy (FNAB): a simple procedure that is done in the doctor's office to determine if a thyroid nodule is benign (non-cancerous) or cancer. The doctor uses a very thin needle to withdraw cells from the thyroid nodule. Patients usually return home or to work after the biopsy without any ill effects.

CLINICAL **THYROIDOLOGY** FOR THE **PUBLIC**

A publication of the American Thyroid Association

AMERICAN THYROID ASSOCIATION
FOUNDED 1923
www.thyroid.org

THYROID NODULES

Can thyroid nodule features on non-contrast CT scans be helpful in the evaluation of thyroid nodules incidentally found on PET/CT scans?

BACKGROUND

Thyroid nodules are commonly found on medical imaging studies, such as Computerized Tomography (CT) scans, 18F-fluorodeoxyglucose (18F-FDG) positron emission tomography/CT (PET/CT) scans, or other imaging studies, which are performed for another reason (ie. the test is ordered without knowledge of the presence of a thyroid nodule). When thyroid nodules are detected on imaging studies performed for another reason, these are referred to as thyroid 'incidentalomas.' One of the questions that comes up after detecting a thyroid incidentaloma, is whether the nodule may be a thyroid cancer, and this question often results in additional testing to address the concern. This study was performed to investigate whether, in thyroid incidentilomas detected on PET/CT scan, the detailed features of the nodule on this the imaging study could predict whether the nodule was a cancer or not.

THE FULL ARTICLE TITLE

Kim D et al. Risk stratification of thyroid incidentalomas found on PET/CT: The value of iodine content on noncontrast computed tomography. Thyroid. September 3, 2015 [Epub ahead of print].

SUMMARY OF THE STUDY

This patient chart review study was performed at Yonsei University College of Medicine in Korea. The study investigators identified 143 patients from their institution, who had thyroid incidentalomas noted upon PET/CT scans in 2011. Of these 143 patients, 61 were excluded from the study for a variety of reasons. The study included the other 82 patients, who had either a thyroid nodule biopsy or surgery to confirm if thyroid nodules were cancerous or not. The reasons why the PET/CT was originally performed was as follows: determining the stage of a known cancer (not thyroid, 33 individuals), follow-up of a known cancer (not thyroid, 32 individuals) and health screening exam to look for any cancer (17 individuals). The average size of the 82 thyroid incidentilomas detected on PET/CT scan was 1.6 cm (range 0.5–4.9 cm). PET/CT images are measured in terms of the maximal standardized uptake value ratios and units known as Hounsfield units (HU). In this study, the maximal standardized uptake value ratios were determined of the thyroid nodule compared to liver (T/BSUV). The authors reported that thyroid cancers had higher average T/BSUV measurements compared to benign nodules. In examining their data further, the authors identified a T/BSUV value being >1.5 as being the best cut-off, to distinguish thyroid cancer from thyroid nodules.

WHAT ARE THE IMPLICATIONS OF THIS STUDY?

The authors of this study concluded that calculation of the T/BSUV value for thyroid incidentilomas identified on PET/CT could be helpful. It is important to note that this was a study in one institution and data were collected by reviewing charts, such that decisions on management of nodules were not made in real-time, based on the T/BSUV measurements. These findings need to be confirmed in another study. Also, it is important for patients who are found to have thyroid incidentilomas on imaging studies to have a frank discussion with their physician on whether the nodule is likely to be clinically important in their situation, as this may help in decision-making about further testing (if needed).

— Anna Sawka, MD

ATA THYROID BROCHURE LINKS

Thyroid Nodules: http://www.thyroid.org/thyroid-nodules/

ABBREVIATIONS & DEFINITIONS

Thyroid nodule: an abnormal growth of thyroid cells that forms a lump within the thyroid. Most thyroid nodules are benign, but thyroid cancer may need to be ruled out, depending on the features of the nodule and clinical situation.

AMERICAN THYROID ASSOCIATION
FOUNDED 1923
www.thyroid.org

THYROID NODULES, continued

Positron-Emission-Tomography (PET) scans: a nuclear medicine imaging test that uses a small amount of radiolabeled glucose to identify cancer. Since cancer cells are more active than normal cells, the cancer cells take up more of the radiolabeled glucose and show up on the PET scan. PET scans are frequently combined with CT scans to accurately identify where the cancer is located. PET/CT images are measured in terms of the maximal standardized uptake value ratios and units known as Hounsfield units (HU).

Thyroid fine needle aspiration biopsy (FNAB): a simple procedure that is done in the doctor's office to determine if a thyroid nodule is benign (non-cancerous) or cancer. The doctor uses a very thin needle to withdraw cells from the thyroid nodule. Patients usually return home or to work after the biopsy without any ill effects.

CLINICAL **THYROIDOLOGY** FOR THE **PUBLIC**

A publication of the American Thyroid Association

AMERICAN THYROID ASSOCIATION
FOUNDED 1923
www.thyroid.org

THYROID CANCER

Dabrafenib increases radioactive iodine uptake in patients with radioactive iodine-resistant thyroid cancer with BRAF-mutation

BACKGROUND

Most patients with thyroid cancer do well, are at low risk and are often cured of their cancer after surgery. Those with higher risk cancers (large cancers that spread outside the thyroid) can be treated with radioactive iodine, which acts as a "magic bullet" to destroy thyroid cancer cells as it is taken up and concentrated within the cells. However, in some patients, the thyroid cancers stop taking up radioactive iodine and are, thus, more difficult to treat as they become resistant to radioactive iodine. In particular, cancers that contain the BRAF-mutation are more likely to become radioactive iodine-resistant. Treatment options are limited for these patients. Newer chemotherapeutic drugs (tyrosine kinase inhibitors, TKI) target essential proteins in thyroid cancer cells and have been shown to be effective in treating these cancer. In particular, dabrafenib is a TKI that can block the BRAF-mutation, possibly allowing the thyroid cancer cells to take up radioactive iodine again. This study was done to determine if dabrafenib could increase the uptake of radioactive iodine in radioactive iodine-resistant thyroid cancer.

THE FULL ARTICLE TITLE

Rothenberg SM et al. Redifferentiation of iodine-refractory BRAF V600E-mutant metastatic papillary thyroid cancer with dabrafenib. Clin Cancer Res. December 30, 2014 [Epub ahead of print].

SUMMARY OF THE STUDY

All patients included in this study were older than 18 years of age (6 males and 4 females) and had thyroid cancer that could not be removed by surgery or was radioactive iodine-resistant. All patients had already received 1-4 previous radioactive iodine treatments. All patients were treated with dabrafenib. A diagnostic radioiodine scan was performed after 25 days in all patients. Dabrafenib treatment was stopped if there was no sign of increased radioactive iodine uptake in the diagnostic scan and was continued for 2 weeks only in patients with increased radioiodine uptake in diagnostic whole-body scan. After 2 weeks, the patients were treated with radioactive iodine and a whole body scan was performed. A total of 6 of 10 patients with dabrafenib treatment showed increased radioactive iodine uptake. Cancer size was reduced in 5 of 6 treated patients. The thyroid cancer marker thyroglobulin was decreased in only in 3 of 6 treated patients. Dabrafenib also caused several significant side effects such as skin lesion, fatigue, weight loss, headache, and hypocalcemia.

WHAT ARE THE IMPLICATIONS OF THIS STUDY?

Dabrafenib increases radioactive iodine uptake in patients with metastatic radioactive iodine-resistant thyroid cancer with BRAF-mutation. This offers another option for treating these patients with high risk thyroid cancers. However, dabrafenib also causes significant side effects. Therefore, the risks and benefits of treatment with this drug should be carefully reviewed with patients.

— Jamshid Farahati, MD

ATA THYROID BROCHURE LINKS

Thyroid Cancer: http://www.thyroid.org/thyroid-cancer/

Radioactive Iodine Therapy: http://www.thyroid.org/radioactive-iodine/

Thyroid Surgery: http://www.thyroid.org/thyroid-surgery/

ABBREVIATIONS & DEFINITIONS

Radioactive iodine (RAI): this plays a valuable role in diagnosing and treating thyroid problems since it is taken up only by the thyroid gland. I-131 is the destructive form used to destroy thyroid tissue in the treatment of thyroid cancer and with an overactive thyroid. I-123 is the non-destructive form that does not damage the thyroid and is used in scans to take pictures of the thyroid (Thyroid Scan) or to take

AMERICAN THYROID ASSOCIATION®
FOUNDED 1923
www.thyroid.org

THYROID CANCER, continued

pictures of the whole body to look for thyroid cancer (Whole Body Scan).

Radioactive iodine uptake (RAIU): this is a measurement of activity of the thyroid gland and is reported as the percent of a dose of radioactive iodine that is retained in the thyroid gland 24 h after the dose is given. An increase in RAIU usually indicates hyperthyroidism.

Tyrosine kinases: proteins that are overactive in many of the pathways that cause cells to be cancerous.

Cancer-associated genes: these are genes that are normally expressed in cells. Cancer cells frequently have mutations in these genes. It is unclear whether mutations in these genes cause the cancer or are just associated with the cancer cells. The cancer-associated genes important in thyroid cancer are BRAF, RET/PTC and RAS.

BRAF gene: this is gene that codes for a protein that is involved in a signaling pathway and is important for cell growth. Mutations in the BRAF gene in adults appear to cause cancer.

Thyroglobulin: a protein made only by thyroid cells, both normal and cancerous. When all normal thyroid tissue is destroyed after radioactive iodine therapy in patients with thyroid cancer, thyroglobulin can be used as a thyroid cancer marker in patients that do not have thyroglobulin antibodies.

ATA Alliance for Thyroid Patient Education

GOAL

The goal of our organizations is to provide accurate and reliable information for patients about the diagnosis, evaluation and treatment of thyroid diseases.

We look forward to future collaborations and continuing to work together towards the improvement of thyroid education and resources for patients.

WHO WE ARE (in alphabetical order)

- **American Thyroid Association**
- **Bite Me Cancer**
- **Graves' Disease and Thyroid Foundation**
- **Light of Life Foundation**
- **ThyCa: Thyroid Cancer Survivors' Association, Inc.**
- **Thyroid Cancer Canada**
- **Thyroid Federation International**

AMERICAN THYROID ASSOCIATION

www.thyroid.org
ATA Patient Resources: http://www.thyroid.org/patients/
Find a Thyroid Specialist: www.thyroid.org
Phone (toll-free): 1-800-THYROID
e-mail: thyroid@thyroid.org

ATA Mission: The ATA leads in promoting thyroid health and understanding thyroid biology.
ATA Vision: The ATA is the leading organization focused on thyroid biology and the prevention and treatment of thyroid disorders through excellence and innovation in research, clinical care, education, and public health.
ATA Values: The ATA values scientific inquiry, clinical excellence, public service, education, collaboration, and collegiality.

To further our mission, vision and values the ATA sponsors "Friends of the ATA" online to advance the information provided to patients and the public such as this publication, *Clinical Thyroidology for the Public*. We welcome your support.

continued on next page

AMERICAN THYROID ASSOCIATION FOUNDED 1923

Light of Life Foundation checkyourneck.com

GRAVES' DISEASE & THYROID FOUNDATION

Thyroid Federation International

ThyCa: Thyroid Cancer Survivors' Association, Inc.SM www.thyca.org

Thyroid Cancer Canada
Cancer de la thyroïde Canada

BITE ME cancer® attitude is everything.

ATA Alliance for Thyroid Patient Education

Continued...

BITE ME CANCER

http://www.bitemecancer.org

Bite Me Cancer was formed as a nonprofit foundation in September, 2010, by Nikki Ferraro, who was 17-years old at the time. Nikki was diagnosed with a rare form of thyroid cancer in April 2010 when she was a junior at Chantilly HS in Virginia. Nikki was determined to lead a Relay for Life team just two weeks after her diagnosis. She named the team Bite Me Cancer and experienced immediate success. When Nikki decided to create a foundation a few months later, she wanted to continue the legacy of her team name and thus her foundation became the Bite Me Cancer Foundation.

e-mail: info@bitemecancer.org

GRAVES' DISEASE AND THYROID FOUNDATION

www.gdatf.org

Phone (toll-free): 1-877-NGDF-123 or 643-3123

e-mail: Gravesdiseasefd@gmail.com

Founded in 1990, the Graves' Disease Foundation offers support and resources to Graves' disease patients, their families, and health care professionals. Their mission is to find the cause of and the cure for Graves' thyroid disease through research, to improve the quality of life for persons with Graves' disease and their caregivers and to educate persons with Graves' disease, their caregivers, healthcare professionals, and the general public about Graves' disease and its treatment. The web site features a monitored bulletin board.

LIGHT OF LIFE FOUNDATION

www.checkyourneck.com

email: info@checkyourneck.com

The Light of Life Foundation, founded in 1997, is a nonprofit organization that strives to improve the quality of life for thyroid cancer patients, educate the public and professionals about thyroid cancer, and promote research and development to improve thyroid cancer care.

continued on next page

AMERICAN THYROID ASSOCIATION
FOUNDED 1923

Light of Life Foundation
checkyourneck.com

GRAVES' DISEASE & THYROID FOUNDATION

ThyCa: Thyroid Cancer Survivors' Association, Inc.
www.thyca.org

Thyroid Federation International

Thyroid Cancer Canada
Cancer de la thyroïde Canada

BITE ME cancer
attitude is everything.

ATA Alliance for Thyroid Patient Education

Continued...

THYCA: THYROID CANCER SURVIVORS' ASSOCIATION, INC.

www.thyca.org
Phone (toll-free): 877 588-7904
e-mail: thyca@thyca.org

ThyCa: Thyroid Cancer Survivors' Association, Inc., founded in 1995, is an international nonprofit organization, guided by a medical advisory council of renowned thyroid cancer specialists, offering support and information to thyroid cancer survivors, families, and health care professionals worldwide.

THYROID CANCER CANADA

www.thyroidcancercanada.org
Phone: 416-487-8267
Fax: 416-487-0601
e-mail: info@thyroidcancercanada.org

Thyroid Cancer Canada is a non-profit organization founded in 2000. The organization works towards creating an environment in which people who are dealing with thyroid cancer, especially the newly diagnosed, are met with support and information. Their goals & objectives include facilitating communication among thyroid cancer patients, providing credible information about the disease, providing emotional support, and assisting thyroid cancer patients with voicing their needs to health care professionals and those who are responsible for health care policy.

THYROID FEDERATION INTERNATIONAL

http://www.thyroid-fed.org/
e-mail: tfi@thyroid-fed.org

Thyroid Federation International (TFI) was established in Toronto in 1995. Thyroid Federation International aims to work for the benefit of those affected by thyroid disorders throughout the world by providing a network of patient support organizations.

AMERICAN THYROID ASSOCIATION
FOUNDED 1923

Light of Life Foundation
checkyourneck.com

GRAVES' DISEASE & THYROID FOUNDATION

ThyCa: Thyroid Cancer Survivors' Association, Inc.SM
www.thyca.org

Thyroid Federation International

Thyroid Cancer Canada
Cancer de la thyroïde Canada

BITE ME cancer
attitude is everything

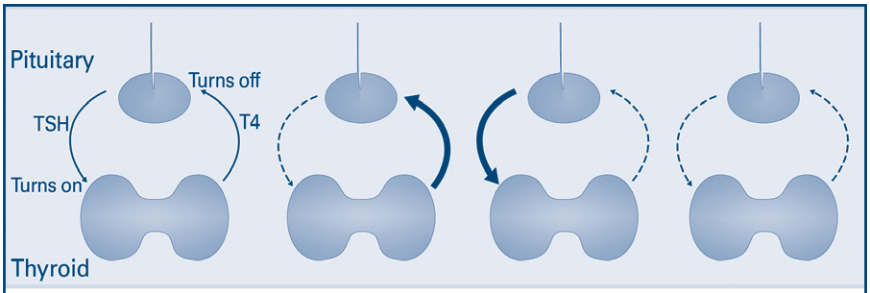
Thyroid Function Tests

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.

FUNCTION

HOW DOES THE THYROID GLAND FUNCTION?
The major thyroid hormone secreted by the thyroid gland is thyroxine, also called T4 because it contains four iodine atoms. To exert its effects, T4 is converted to triiodothyronine (T3) by the removal of an iodine atom. This occurs mainly in the liver and in certain tissues where T3 acts, such as in the brain. The amount of T4 produced by the thyroid gland is controlled by another hormone, which is made in the pituitary gland located at the base of the brain, called thyroid stimulating hormone (abbreviated TSH). The amount of TSH that the pituitary sends into the blood stream depends on the amount of T4 that the pituitary sees. If the pituitary sees very little T4, then it produces more TSH to tell the thyroid gland to produce more T4. Once the T4 in the blood stream goes above a certain level, the pituitary's production of TSH is shut off. In fact, the thyroid and pituitary act in many ways like a heater and a thermostat. When the heater is off and it becomes cold, the thermostat reads the temperature and turns on the heater. When the heat rises to an appropriate level, the thermostat senses this and turns off the heater. Thus, the thyroid and the pituitary, like a heater and thermostat, turn on and off. This is illustrated in the figure below:



CONDITION:	Normal	Hyperthyroidism	Hypothyroidism Primary	Hypothyroidism Secondary
TSH	Normal	Low	High	Low
T4	Normal	High	Low	Low

T4 and T3 circulate almost entirely bound to specific transport proteins, and there are some situations which these proteins could change their level in the blood, producing also changes in the T4 and T3 levels (it happens frequently during pregnancy, women who take control birth pills, etc)

Another measurement done to assess the thyroid status of patients is the Free T4 measurement. The Free T4 avoids any change the proteins could have, giving us a more accurate value for the T4 level (see below).

TESTS

Blood tests to measure TSH, T4, T3 and Free T4 are readily available and widely used.

Tests to evaluate thyroid function include the following:

TSH TESTS

The best way to initially test thyroid function is to measure the TSH level in a blood sample. A high TSH level indicates that the thyroid gland is failing because of a problem that is directly affecting the thyroid (primary hypothyroidism). The opposite situation, in which the TSH level is low, usually indicates that the person has an overactive thyroid that is producing too much thyroid hormone (hyperthyroidism). Occasionally, a low TSH may result from an abnormality in the pituitary gland, which prevents it from making enough TSH to stimulate the thyroid (secondary hypothyroidism). In most healthy individuals, a normal TSH value means that the thyroid is functioning normally.

T4 TESTS

T4 circulates in the blood in two forms:

1) T4 bound to proteins that prevent the T4 from entering the various tissues that need thyroid hormone.

2) Free T4, which does enter the various target tissues to exert its effects. The free T4 fraction is the most important to determine how the thyroid is functioning, and tests to measure this are called the Free T4 (FT4) and the Free T4 Index (FT4I or FTI). Individuals who have hyperthyroidism will have an elevated FT4 or FTI, whereas patients with hypothyroidism will have a low level of FT4 or FTI.

Thyroid Function Tests

Combining the TSH test with the FT4 or FTI accurately determines how the thyroid gland is functioning.

The finding of an elevated TSH and low FT4 or FTI indicates primary hypothyroidism due to disease in the thyroid gland. A low TSH and low FT4 or FTI indicates hypothyroidism due to a problem involving the pituitary gland. A low TSH with an elevated FT4 or FTI is found in individuals who have hyperthyroidism.

T3 TESTS

T3 tests are often useful to diagnosis hyperthyroidism or to determine the severity of the hyperthyroidism. Patients who are hyperthyroid will have an elevated T3 level. In some individuals with a low TSH, only the T3 is elevated and the FT4 or FTI is normal. T3 testing rarely is helpful in the hypothyroid patient, since it is the last test to become abnormal. Patients can be severely hypothyroid with a high TSH and low FT4 or FTI, but have a normal T3. In some situations, such as during pregnancy or while taking birth control pills, high levels of total T4 and T3 can exist. This is because the estrogens increase the level of the binding proteins. In these situations, it is better to ask both for TSH and free T4 for thyroid evaluation.

THYROID ANTIBODY TESTS

The immune system of the body normally protects us from foreign invaders such as bacteria and viruses by destroying these invaders with substances called antibodies produced by blood cells known as lymphocytes. In many patients with hypothyroidism or hyperthyroidism, lymphocytes make antibodies against their thyroid that either stimulate or damage the gland. Two common antibodies that cause thyroid problems are directed against thyroid cell proteins: thyroid peroxidase and thyroglobulin. Measuring levels of thyroid antibodies may help diagnose the cause of the thyroid problems. For example, positive anti-thyroid peroxidase and/or anti-thyroglobulin antibodies in a patient with hypothyroidism make a diagnosis of Hashimoto's thyroiditis. If the antibodies are positive in a hyperthyroid patient, the most likely diagnosis is autoimmune thyroid disease.

THYROGLOBULIN

Thyroglobulin (Tg) is a protein produced by normal thyroid cells and also thyroid cancer cells. It is not a measure of thyroid function and it does not diagnose thyroid cancer when the thyroid gland is still present. It is used most often in patients who have had surgery for thyroid cancer in order to monitor them after treatment. Tg is included in this brochure of thyroid function tests to communicate that, although measured frequently in certain scenarios and individuals, Tg is not a primary measure of thyroid hormone function.

NON-BLOOD TESTS

RADIOACTIVE IODINE UPTAKE

Because T4 contains much iodine, the thyroid gland must pull a large amount of iodine out from the blood stream in order for the gland to make an appropriate amount of T4. The thyroid has developed a very active mechanism for doing this. Therefore, this activity can be measured by having an individual swallow a small amount of iodine, which is radioactive. The radioactivity allows the doctor to track where the iodine molecules go. By measuring the amount of radioactivity that is taken up by the thyroid gland (radioactive iodine uptake, RAIU), doctors may determine whether the gland is functioning normally. A very high RAIU is seen in individuals whose thyroid gland is overactive (hyperthyroidism), while a low RAIU is seen when the thyroid gland is underactive (hypothyroidism). In addition to the radioactive iodine uptake, a thyroid scan may be obtained, which shows a picture of the thyroid gland (see *Thyroid Nodules brochure*).

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***.