2025 City of Hope Multidisciplinary Thyroid Cancer Symposium

Radiofrequency Ablation of Thyroid Nodules: Who, When, and How?

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City of Hope

Disclosures

- Consultant for Boston Scientific, and Ethicon.

This presentation and/or comments will be free of any bias toward or promotion of the above referenced companies or their product(s) and/or other business interests.

This presentation and/or comments will provide a balanced, non-promotional, and evidence-based approach to all diagnostic, therapeutic and/or research related content.

This presentation has been peer-reviewed and no conflicts were noted.

Cultural Linguistic Competency (CLC) & Implicit Bias (IB)

STATE LAW:

The California legislature has passed Assembly Bill (AB) 1195, which states that as of July 1, 2006, all Category 1 CME activities that relate to patient care must include a cultural diversity/linguistics component. It has also passed AB 241, which states that as of January 1, 2022, all continuing education courses for a physician and surgeon **must** contain curriculum that includes specified instruction in the understanding of implicit bias in medical treatment.

The cultural and linguistic competency (CLC) and implicit bias (IB) definitions reiterate how patients' diverse backgrounds may impact their access to care.

EXEMPTION:

Business and Professions Code 2190.1 exempts activities which are dedicated solely to research or other issues that do not contain a direct patient care component.

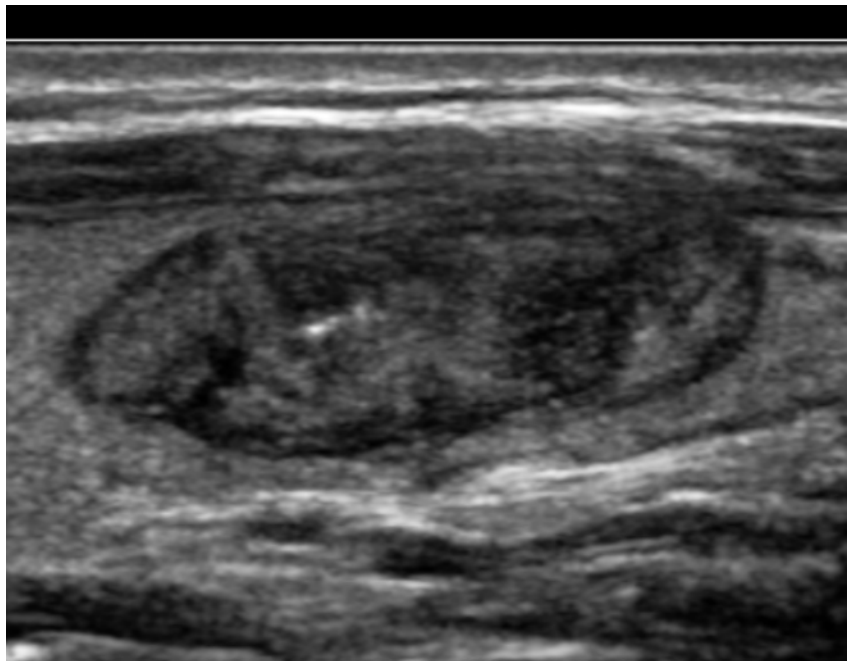
This presentation is dedicated solely to research or other issues that do not contain a direct patient care component.

Outline

- Background
- Indications
  - Pt selection and pre-procedural work up
  - Technique
    - Risks/complications
  - Post-procedural follow-up
- Outcomes

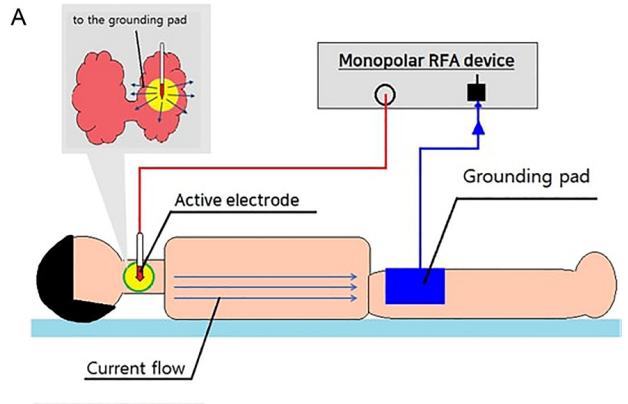
Background

- 16 million Americans palpable thyroid nodules
  - Mass effect
    - Pain
    - Pressure
    - Globus sensation
    - Breathing or swallowing difficulty
  - Cosmetic
- Treatment options
  - Surgical resection



Background

- Radiofrequency Ablation (RFA)
  - High frequency alternating electrical current
    - local tissue agitation ➡ frictional heat ➡ conductive heat
  - Cell death achieved at 60 C
  - Widely used in clinical practice since 1990's (liver, lung, kidney and bone)
  - International use for >20 yrs
  - FDA clearance for thyroid in 2018



Jung Techniques in Vasc and inter Rad 2022

Indications

- Absolute
  - Benign, non-functional, symptomatic nodules
- Relative
  - Autonomously functioning nodules
  - Papillary microcarcinoma
  - PTC recurrence
  - Parathyroid adenoma

Pre-procedural evaluation

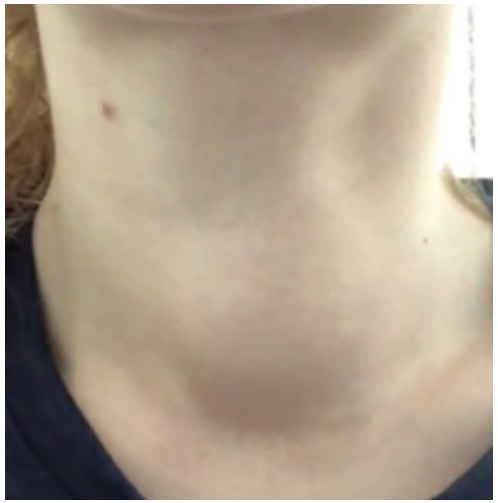
- Benign
  - 2 USGFNA/CNBx negative
  - 1 USGFNA/CNBx if AFTN or highly specific benign US features
- Non-functional
  - TSH, Free T4, Free T3
  - TSI, TPO, Thyroglobulin antibody
- Symptomatic nodules
  - Symptom Score (VAS 0-10)
    - Swallowing symptoms, voice changes, hyperthyroid
  - Cosmetic Score (0-4)
    - No palpable mass
    - Palpable without cosmetic issue
    - Cosmetic issue with swallowing
    - Readily detectable problem

Patient Selection

- Ultrasound
  - Size/Volume measurement
    - Volume = π/6ABC = 0.523ABC
  - Features Solid vs Cystic (vascularity, calcifications, etc)
  - Location (proximity to vital structures)

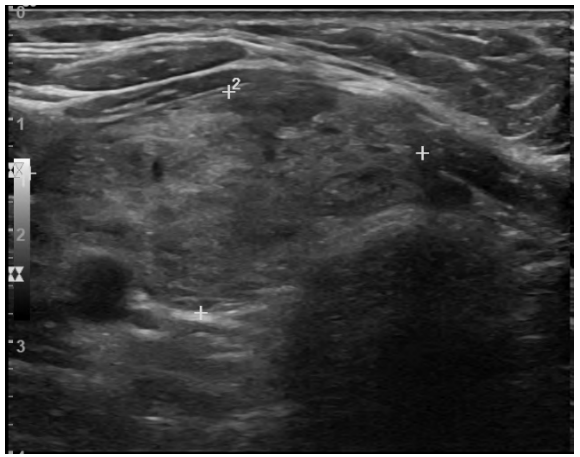
Patient Selection

- Nodule Size
  - No absolute guidelines for nodule size
    - Symptoms may vary based on pt anatomy
  - >20 ml (3-4 cm) “large nodule”
  - Can the pt be managed in a “reasonable” number of sessions (staged procedure)
    - 20-30 ml per session
  - Contraindications
    - Significant infraclavicular extension, heavy calcification, cystic



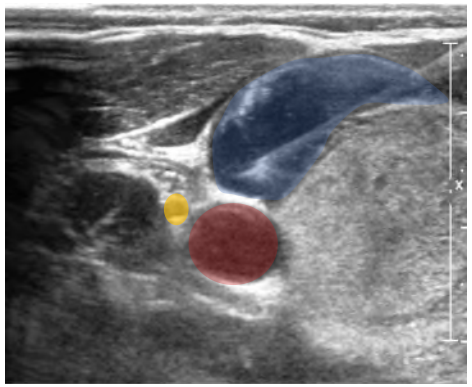
Procedure

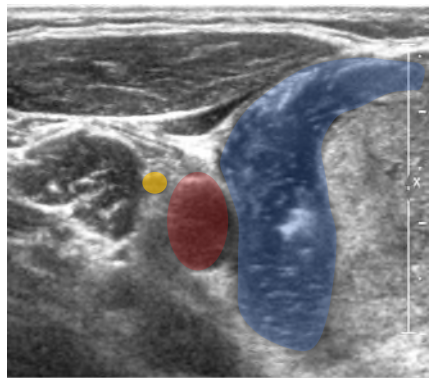
- Outpatient procedure
  - oLocal anesthesia (oral anxiolytic if needed)
    - Patients should be awake and conversant during procedure
  - oTechniques
    - Pericapsular LA
    - Hydrodisplacement
    - Trans-isthmic- Moving shot
    - Danger Triangle



Procedure

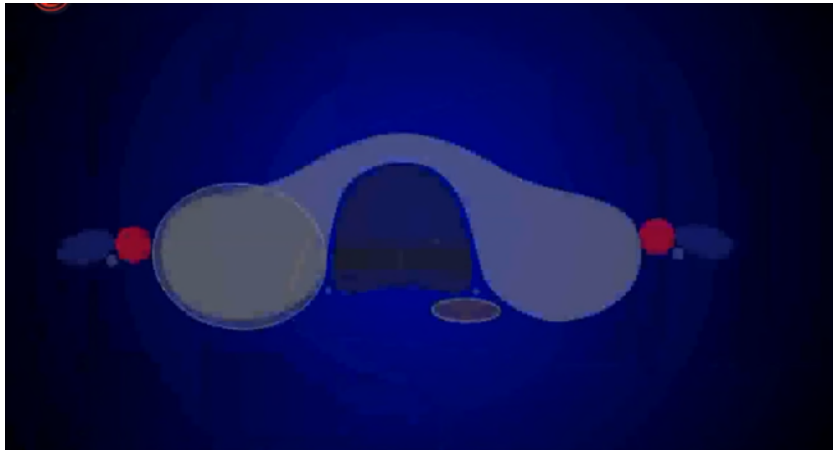
- 1% lidocaine + 0.5% bupivacaine + D5 between true and false capsule
  - Provide local anesthesia
  - Displace adjacent vessels and nerves





Procedure

- Transisthmic – Moving shot technique
  - oMinimize motion
  - oDirect needle tip away from danger triangle (tracheoesphageal groove)
  - oSystematic overlapping spheres of ablation



Procedure

- Post-procedure
  - Ice pack
  - NSAIDs
  - Clinical follow up
    - 1,3,6,12 months
    - US 1,6,12 months

Complications and Side effect

- Side effects
  - Soreness/pain
  - Fever
- Minor complications
  - Hematoma
  - Skin burn
  - Vasovagal
  - Coughing
  - Lidocaine toxicity
- Major complications
  - Nerve injury
  - Nodule rupture
  - Hypothyroid
  - Tracheal or esophageal injury

Table 2

Complications and Side Effects in 1459 Patients Who Underwent RF Ablation of Thyroid Nodules

Complication or Side Effect	No. of Complications	Time of Detection (d)	Time to Recovery (d)
Major	20 (1.4)	1–180	1–90
Voice change	15 (1.02)	1–2	1–90
Nodule rupture	2 (0.14)	22–30	<30
Nodule rupture with abscess formation*	1 (0.07)	50	None
Hypothyroidism*	1 (0.07)	180	None
Brachial plexus injury	1 (0.07)	1	60
Minor	28 (1.92)	1–2	1–30
Hematoma	15 (1.02)	1	<30
Vomiting	9 (0.62)	1–2	1–2
Skin burn	4 (0.27)	1	<7
Side effect	46 (3.15)	1	1–2
Pain	38 (2.6)	1	1–2
Vasovagal reaction	5 (0.34)	1	1
Coughing	3 (0.21)	1	1

[No Title]

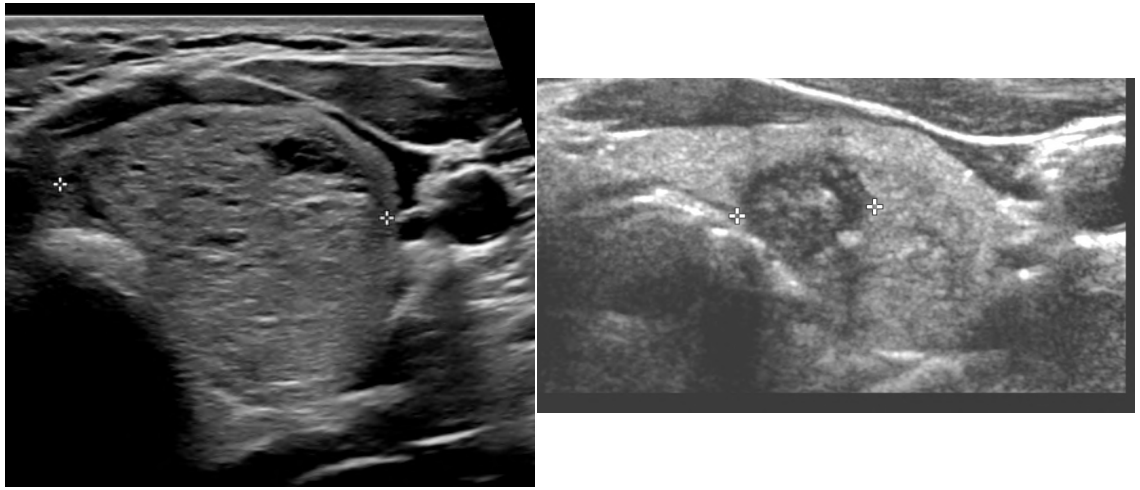
Note.—Number in parentheses is percentage of complications per total patients.

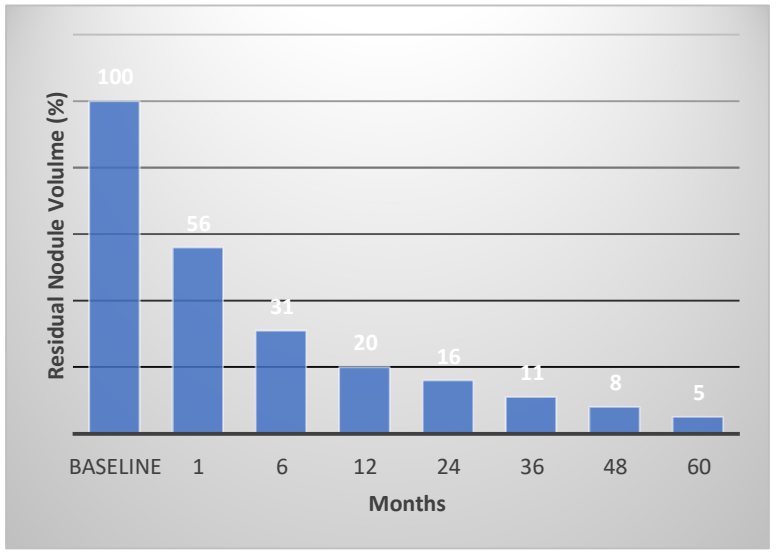
* Complications with remaining sequela.

Baek Et al. Radiology 2012

Outcomes

- US
  - o Hypoechoic devascularized
  - o Slow volume reduction (majority in 3-6 months)
    - Approx 80-95% volume reduction





Jung, et al . KJR. 2018 Jan-Feb: 19(1)

Outcomes (KJR 2018)

Efficacy and Safety of Radiofrequency Ablation for Benign Thyroid Nodules: A Prospective Multicenter Study

So Lyung Jung, MD[3], Jung Hwan Baek, MD, PhD[1], Jeong Hyun Lee, MD[1], Young Kee Shong, MD[2], Jin Yong Sung, MD[4], Kyu Sun Kim, MD[4], Ducky Lee, MD[5], Ji-hoon Kim, MD[6], Seon Mi Baek, MD[7], Jung Suk Sim, MD, PhD[8], Dong Gyu Na, MD[9]

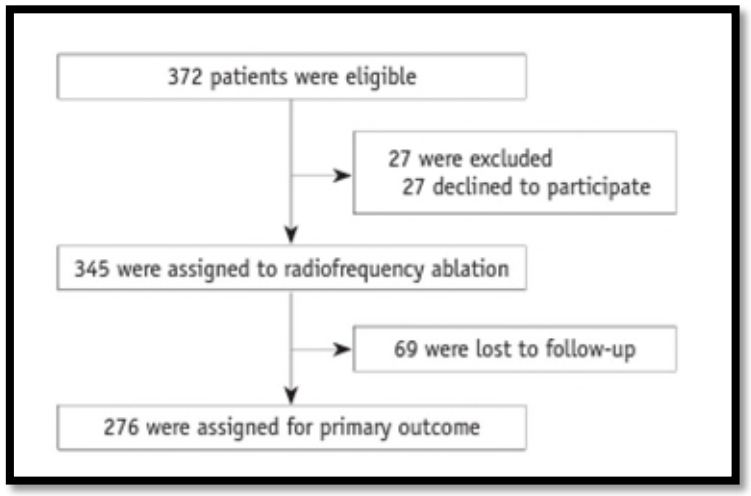


Table 1. Demographic Characteristics of Enrolled Patients

Characteristic	RF Ablation (n = 345)
Sex (male:female)	43:302
Age (years)	46.0 ± 12.7 (15–79)
Nodule diameter (cm)	3.8 ± 1.1 (1.9–8.0)
Nodule volume (mL)	14.2 ± 13.2 (1.1–80.8)
Symptom score	2.5 ± 1.8 (0–8)
Cosmetic score	3.7 ± 0.6 (2–4)
Vascularity	2.0 ± 0.8 (0–3)

Values represent mean ± SD; numbers in parenthesis represent range. RF = radiofrequency, SD = standard deviation

Outcomes

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Table 3. Outcomes for 276 Benign Thyroid Nodules after RF ablation

Variables	Before	1 Month	12 Months	*P**
Largest diameter	3.8 ± 1.1	3.0 ± 1.0	2.0 ± 1.0	< 0.001
Volume	14.2 ± 13.2	8.1 ± 8.8	3.2 ± 4.7	< 0.001
Volume reduction rate (%)		44.4 ± 17.0	80.3 ± 13.7	
Symptom score	2.5 ± 1.8	1.3 ± 1.2	0.4 ± 0.6	< 0.001
Cosmetic score	3.7 ± 0.6	2.9 ± 0.9	1.9 ± 0.9	< 0.001
Vascularity	2.0 ± 0.8	0.6 ± 0.8	0.6 ± 0.9	< 0.001
Therapeutic success (%)†	-	-	270/276 (97.8)	

Values represent means ± SD except for therapeutic success. *Comparison of values before treatment and at 12 months, †Therapeutic success (volume reduction > 50%)

Outcomes

Long-Term Efficacy of a Single Session of RFA for Benign Thyroid Nodules: A Longitudinal 5-Year Observational Study

J Clin Endocrinol Metab, September 2019, 104(9):3751–3756

- 215 pt single center study
- 5 year follow up

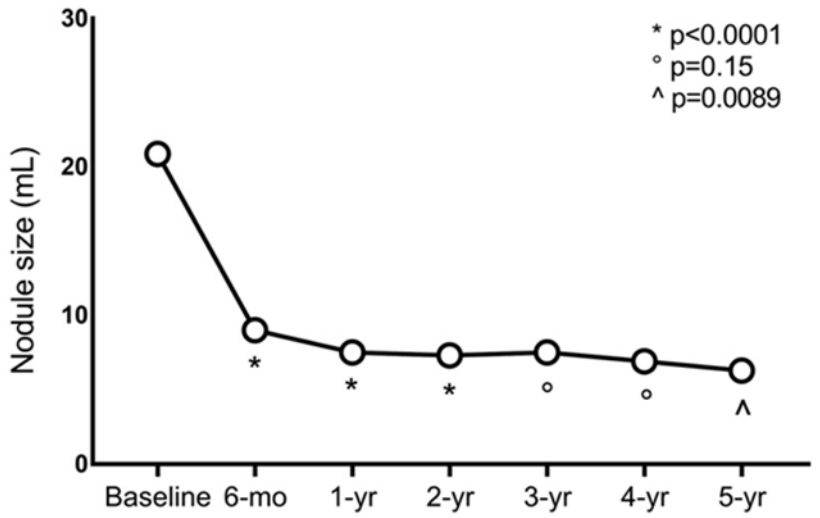


Table 2. Percentage of Volume Reduction Recorded for All Nodules According to Baseline Size

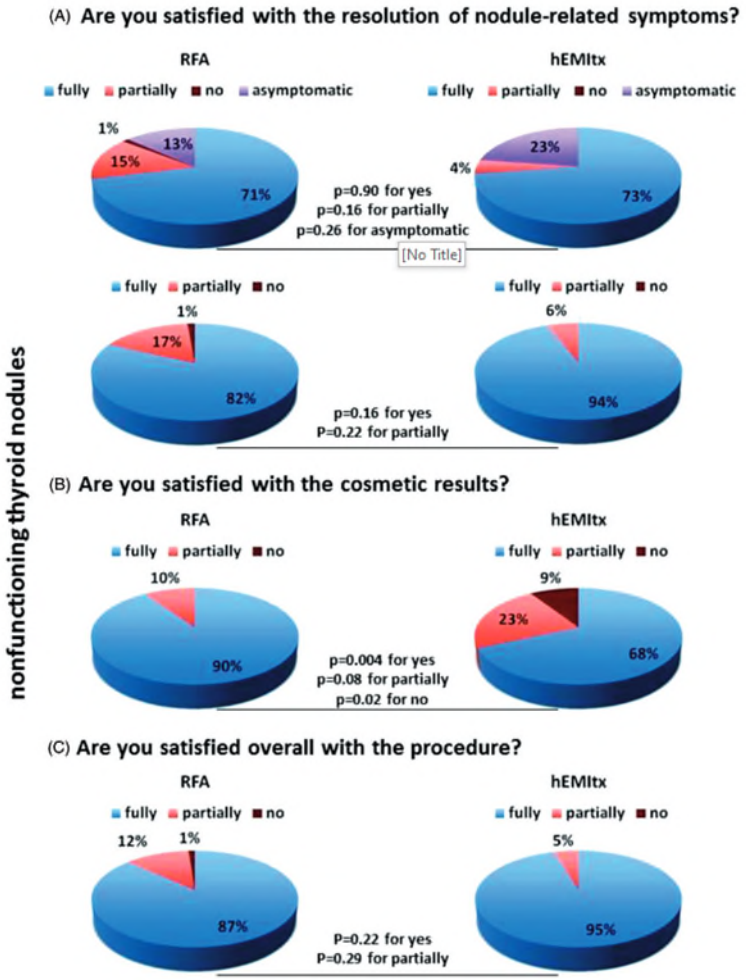
Variable	6 mo	1 y	2 y	3 y	4 y	5 y
All nodules	56.2[a]	63[a]	67.4[a]	66.7	66.9	66.9
<10 mL	79[a]	78	76.8	76.8	75	81.8
≥10 and <20 mL	59[a]	66.7[a]	74.2[a]	74.2	70	74.5
≥20 mL	54.5[a]	60.9[a]	62.4[b]	62.4	62	65.3

Outcomes

- Bernardi et al Int J Hyperthermia 2018
  - Cross sectional study of 126 RFA vs 84 hemithyroidectomy
  - Phone survey results

Table 2. Nodule volume reduction after RFA.

	Baseline	1 month	1 year	2 years	*p* Value
			All nodules		
Patients	(115)	(115)	(115)	(94)	
Volume (mL)	18.0 ± 16.1	9.4 ± 10.1	5.1 ± 6.7	4.7 ± 8.4	<.001
			Nonfunctioning thyroid nodules		
Patients	(83)	(83)	(83)	(66)	
Volume (mL)	18.3 ± 17.2	9.9 ± 11.4	5.5 ± 7.7	5.3 ± 9.8	<.001
			Autonomously functioning thyroid nodules		
Patients	(32)	(32)	(32)	(28)	
Volume (mL)	16.9 ± 12.8	8.3 ± 5.8	3.9 ± 3.1	3.5 ± 3.4	<.001

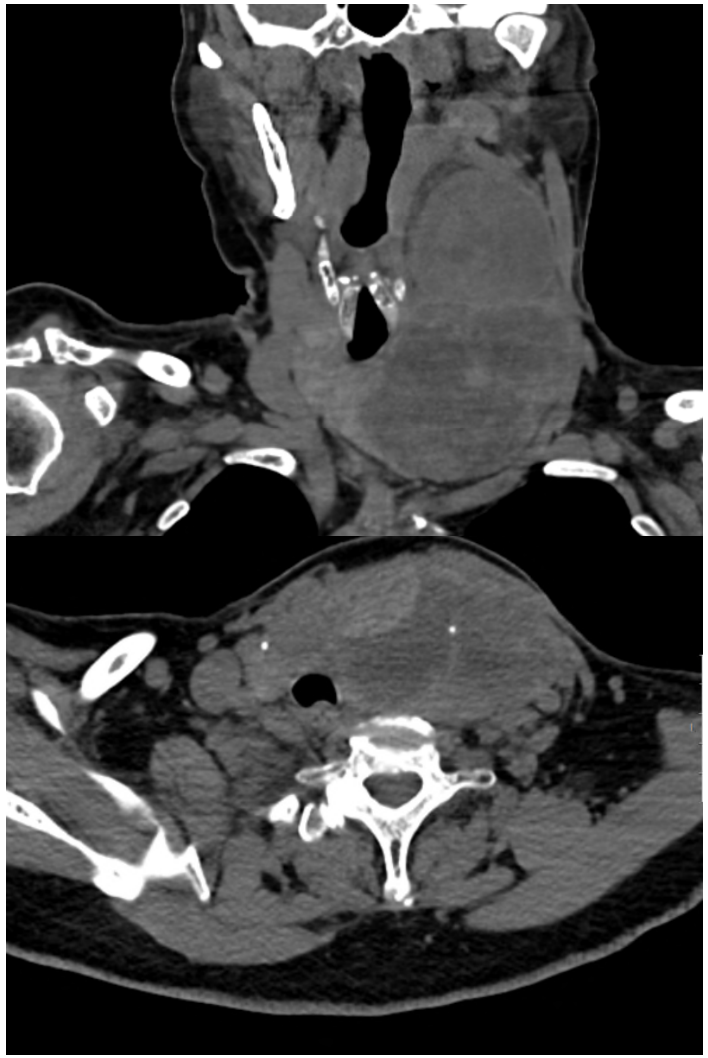


Patient satisfaction after thyroid RFA versus surgery for benign thyroid nodules: a telephone survey

Stella Bernardi[a,b], Chiara Dobrinja[b], Anna Carere[a], Fabiola Giudici[c], Veronica Calabrò[b], Fabrizio Zanconati[a,b], Nicolò de Manzini[a,b], Bruno Fabris[a,b] and Fulvio Stacul[d]

What about VERY LARGE NODULES

- Currently surgical resection is the standard
- Surgery may have increased risk of complication in very large goiters
- Needle ablation techniques may be inadequate or inefficient alternatives

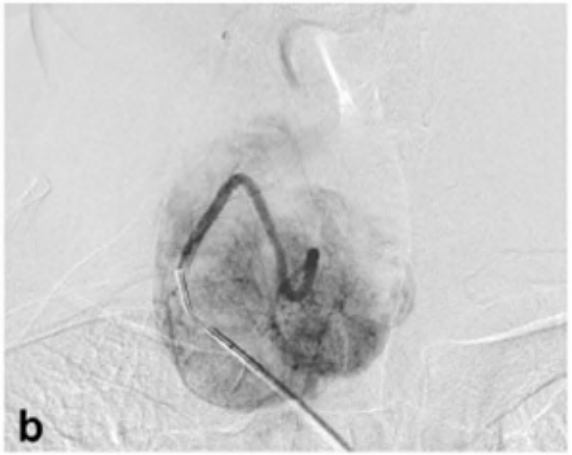


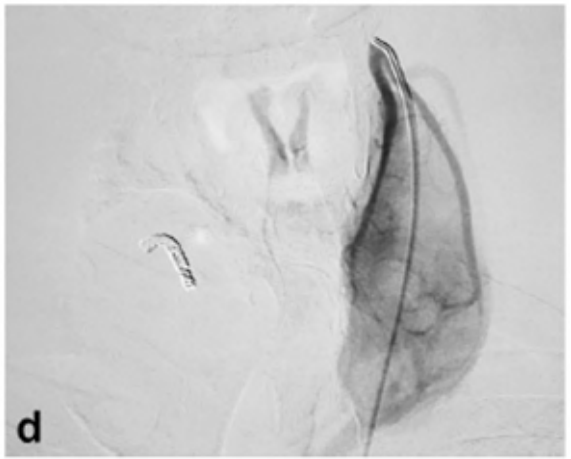
What about VERY LARGE NODULES

Thyroid Embolization for Nonsurgical Treatment of Nodular Goiter: A Single-Center Experience in 56 Consecutive Patients

Saim Yilmaz, MD, Hatice Arıöz Habibi, MD, Akin Yildiz, MD, and Hasan Altunbas, MD

- Single Center analysis of 56 patients treated with embolization
  - 2 major complications (groin hematoma, transient hyperthyroid)
  - Mean volume reduction
    - Nodule: 80 ml to 25 ml
    - Thyroid: 147 ml to 62 ml
  - Mean Hormone change
    - 28 pts euthyroid before treatment with no change
    - 19/22 non-Graves hyperthyroid pts became euthyroid post treatment
    - Symptom and hormone improvement in 25 Graves patients

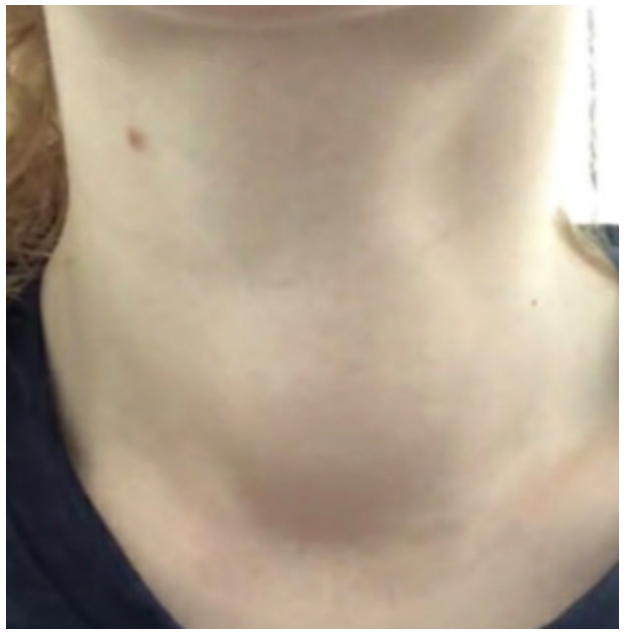


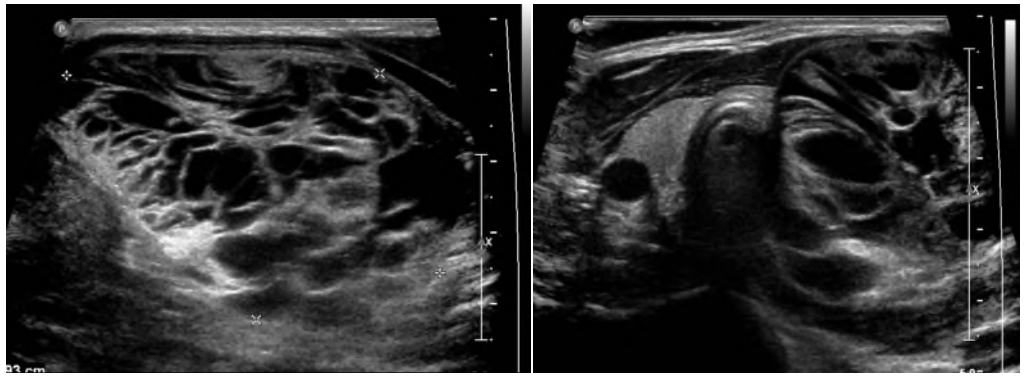


Cases

City of Hope®

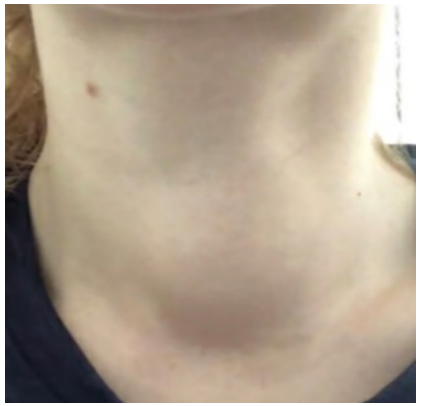
Case 1



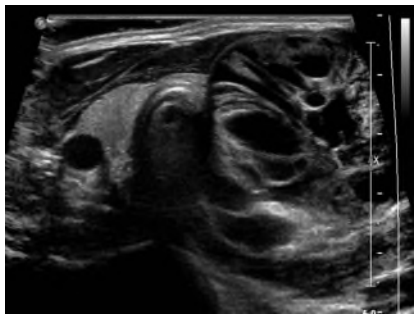


58 mL

Courtesy of Dr Michael Douek, UCLA Medical Center



4/6/2021



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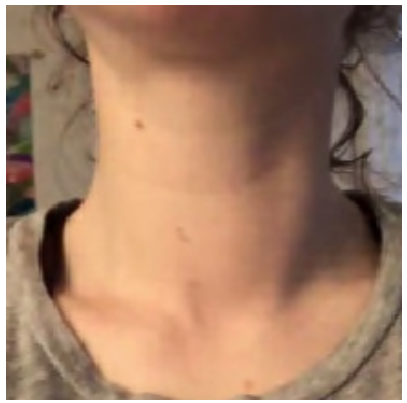
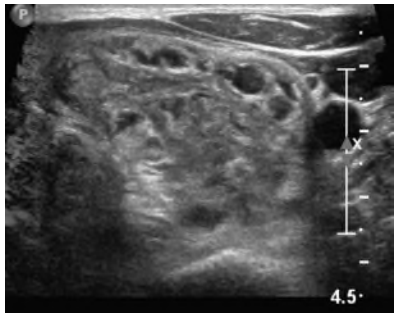
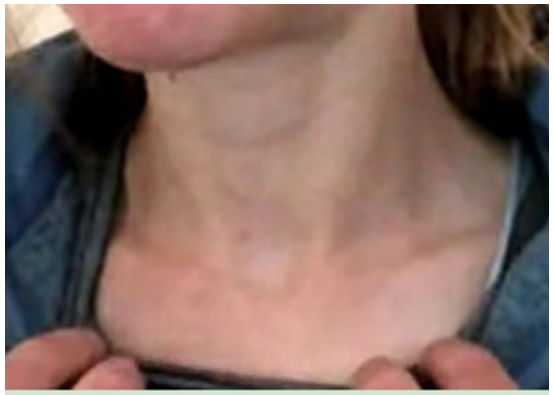


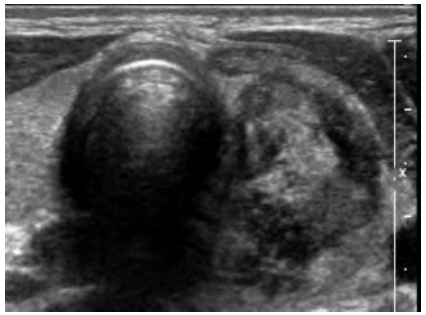
5/6/2021 (1 month)



23 mL
VRR = 61%



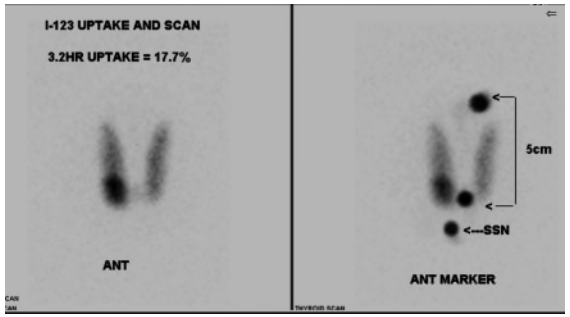
2/18/2022



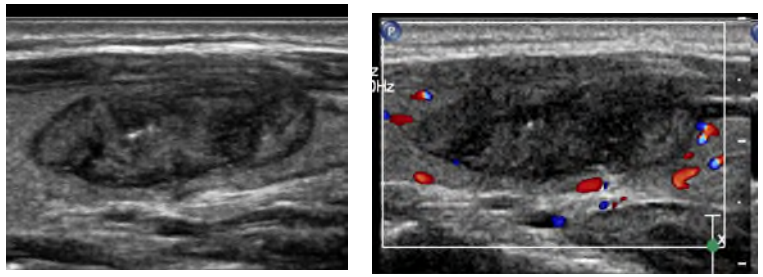
5.2 mL
VRR = 91% at 10 months

Courtesy of Dr Michael Douek, UCLA Medical Center

Case 2



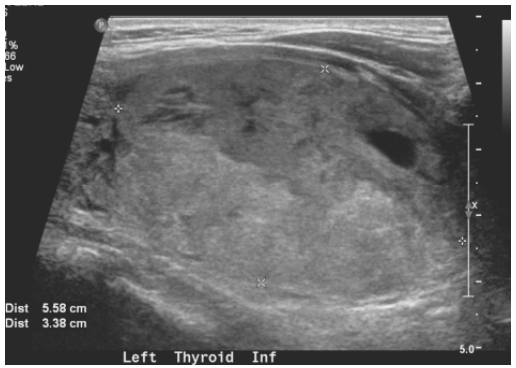
- *Follow-up at 1 month:*
  - Normalized TFTs off methimazole
  - VRR of 33%
  - Durable biochemical response at >24 months



Follow-up US at 1 month: VRR = 33%

Courtesy of Dr Michael Douek, UCLA Medical Center

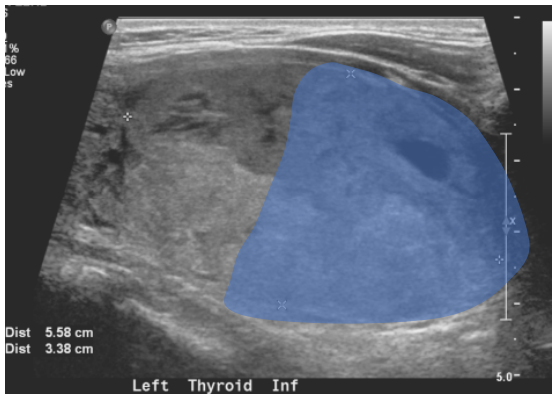
Case 3



11/9/2021
Volume = 52 mL

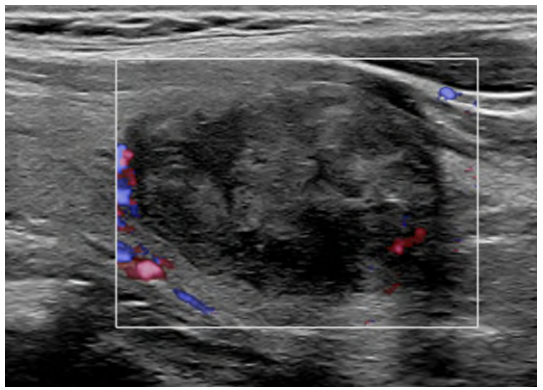
Courtesy of Dr Michael Douek, UCLA Medical Center

“Staged” ablation



11/9/2021
Volume = 52 mL

12/5/2021



10/21/2022
Volume = 6 mL,
VRR = 88% at 11 months

Courtesy of Dr Michael Douek, UCLA Medical Center

Summary

- Thyroid RFA is a safe and effective, minimally-invasive treatment for benign thyroid nodules
- Optimal patient selection and rigorous technique provide for durable outcomes
- Expanded indications for functional nodules and malignancy are on the horizon
- Thyroid artery embolization is a promising technique that may be indicated in non-surgical patients with large glands