## A Breakthrough In Thyroid Nodule/Tumour Treatment: No Surgery! No Scar!- Just A Needle!



Presented by

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# **Topics of Discussion**

• Some common Cases

• Radio Frequency Ablation of Thyroid Nodule /Toumour

# Common Cases of Thyroid Disorder





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# **Case Summary-1**

- Patient: Mrs. Fatema Begum, 40 years
  Referred from Physical Medicine (LBP)
  - TSH: 6.8 mIU/L

#### **History**:

•Complaints: No Cold intolerance and weight gain and menstrual abnormality

- Not any issue with pregnancy
- •No thyroid symptoms or family history
- Not on medications

### **Clinical Examination**

No goiter or neck tenderness,No dry skin, edema, or delayed reflexes

Laboratory Findings •Free T4: 14 pmol/l (10 – 23) pmol/L

> Anti-TPO Antibody: Negative
> Lipid Profile: Mildly elevated LDL

#### Subclinical Hypothyroidism (SCH)

- . Elevated TSH
- . Normal Free T4
- . No thyroid autoimmunity (TPO Ab negative)

## Case Summary -1





# **Hillary Clinton**

# Case-2

#### Case: Mrs. Shirin Akhter, 30 yrs, 10 weeks pregnant

**TSH:** 4.2 mIU/L (Above trimester-specific ULN ~4.0)



□Free T4: 12 pmol/l (10 – 23) pmol/L

**Anti-TPO Antibody:** Positive

**Symptoms:** None

**Exam:** Normal (no goiter, no edema, BP/HR normal)

**Pregnancy Status:** G2P1, 1st trimester, routine check-up



# •SCH in Pregnancy

#### SCH in Pregnancy (Recommendation) ATA 2017 TSH (mIU/L) **TPO-Ab Positive TPO-Ab** Negative Recommendation Normal range in 1st X Do not treat X Do not treat **≤ 2.5** trimester Consider Consider LT4 if X Observe > 2.5 - 4.0 Treating TPO+ Consider Treat if TPO+; Treat > 4.0 - 10Consider if TPO-Treating **Overt** > 10 Treat Treat hypothyroidism –

Treat all

# Target of TSH in Pregnancy

Trimester	Recommended TSH Range (mIU/L)
1st Trimester	0.1 – 2.5
2nd Trimester	0.2 – 3.0
<b>3rd Trimester</b>	0.3 – 3.0

# Follow Up: Every 4 weeks

# Case -3:

- TSH: <0.01 mIU/L (suppressed)
- 4 weeks of pregnancy
- Referred for G&O Dept



**Key Findings:** 

- •No previous thyroid disease, no palpitations, no tremor
- •Vitals: BP 100/70 mmHg, HR 96 bpm
- •Examination: Dehydrated, no goiter, no ophthalmopathy
- Investigations:
- Free T4: Mildly elevated (e.g., 1.9 ng/dL; normal: 0.8–1.7)
- Total T4: Mildly elevated (e.g., 15 µg/dL; normal: 5–12)
- β-hCG: Very high
- Anti-TPO & TRAb: Negative
- •Ultrasound: Singleton viable pregnancy

# What is The Diagnosis?



### **Gestational Thyrotoxicosis (GT)**

- . TSH suppression due to **excess β-hCG** (TSH-like activity)
- . Typically occurs in **1st trimester** with **hyperemesis** gravidarum
- . No intrinsic thyroid disease (TRAb negative, no goiter)

# Kate Middleton (Catherine, Princess of Wales)



#### **Management of Gestational Thyrotoxicosis:**

- Supportive care only, as it is transient and self-limiting
  - IV fluids, electrolyte correction
  - Anti-emetics (e.g., doxylamine-pyridoxine)
  - Nutritional support if needed
- No anti-thyroid drugs (ATDs) unless symptoms are severe or prolonged
- Monitor thyroid function every 2–4 weeks
- Usually resolves by 14–16 weeks gestation

Feature	Gestational Thyrotoxicosis	Graves' Disease in Pregnancy
Cause	β-hCG-induced thyroid stimulation	Autoimmune (TRAb-mediated)
Onset	1st trimester (peaks ~10–12 weeks)	Can occur at any time, often before pregnancy
тѕн	Suppressed	Suppressed
Free T4/T3	Mildly elevated	Often moderately to severely elevated
TRAb (TSI)	Negative	Positive
Goiter / Eye signs	Absent	Common
Hyperemesis	Common	Less common
Treatment	Supportive only	Anti-thyroid drugs (e.g., PTU in 1st trimester)
Prognosis	Resolves spontaneously after 1st trimester	Needs monitoring and treatment throughout pregnancy

#### George H. W. Bush (41st U.S. President) and Barbara Bush (First Lady)



### Case-5

**Patient:** Mr. Mahmud Hossain, 42 years, **Complaint:** Fatigue, weight gain, cold intolerance, dry skin for 3 months

#### **Key Clinical Clues:**

•Lethargy, mental slowing, hoarseness, low libido

•No goiter

•Exam: Bradycardia (HR 54), dry skin, puffy face, delayed reflexes, gynecomastia

### Lab Findings:

•TSH: 1.2 mIU/L(0.5-5,5micMol/L)

- Free T4: 0.5 ng/dL; normal: 0.8–1.7)  $\downarrow \rightarrow Confirms hypothyroidism$
- Free T3: Borderline low

- Cortisol (AM): 3.0  $\mu$ g/dL  $\downarrow \rightarrow$  Central adrenal insufficiency
- FSH/LH/Testosterone: All  $\downarrow \rightarrow$  Hypogonadotropic hypogonadism
- **Prolactin:** Mildly  $\uparrow \rightarrow$  *Pituitary stalk effect*

## **Diagnosis: Secondary Hypothyroidism**

Due to **pituitary failure**  $\rightarrow$  Low FT4 with normal TSH + Other pituitary hormone deficiencies (panhypopituitarism)

# **Oprah Winfrey**





### Sequence of Thyroiditis



# Subacute Thyroiditis



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Busan, S. Korea

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# Radio Frequency Ablation of Thyroid Nodule/Tumour

#### Traditional guideline of Thyroid Nodule Approach



#### Current guideline of Thyroid Nodule Approach




### Updated Guideline of Thyroid Nodule Approach(KJR-23)





Updated Guideline of Thyroid Nodule Approach(KJR)

### Benign Nodule

Symptoms, Increasing size, cosmetics issue and, Anxiety



## Introduction to Thyroid Nodules

What is Nodule: Over growth of tissue in thyroid

### Nodule vs Tumor ?

- Smaller and less likely malignant vs larger and higher potential for malignancy.
- $\blacktriangleright$  Most are benign; malignancy rate  $\approx$  5–15% vs Higher risk of malignancy or already malignant,



Epidemiology:

**Detection Method** 

### Prevalence

**Clinical palpation** 

Ultrasound (Sonography)

~19%–68%, depending on age, sex, iodine status

~4%–7% of the adult population

**Autopsy studies** 

~30%-60%

Prevalence increases with age, female sex, and in iodine-deficient areas.

The **majority of nodules are benign**, and only about **5%–15% are malignant** based on clinical and cytological assessment.

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### What happened if leave untreted

#### 1. Cancer Risk

•About 5%–15% of nodules may be malignant

•Requires biopsy and follow-up to rule out thyroid cancer

### 2. Pressure Symptoms

•Difficulty swallowing

•Neck discomfort or tightness

•Breathing difficulty (especially when lying flat or if retrosternal)

### **3. Hormonal Imbalance**

- Hyperthyroidism if nodule is autonomously functioning (toxic nodule)
- hypothyroidism if part of chronic thyroiditis

### 4. Cosmetic Concerns

Embarrassment or distress due to appearance

### 5. Nodule Growth Over Time

•May enlarge, causing increasing symptoms

•Can require **repeat imaging** and possible **intervention** 

#### 6. Anxiety and Uncertainty

- •Fear of cancer or complications
- •Repeated evaluations, biopsies, and follow-ups may cause stress

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# Sofia Vergara (actress)

scovery of a ind now takes



# Traditional choice of Treatment: Surgery

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# **Problem of Surgery**

- Complications Related to Anesthesia
- Infection
- Bleeding and Hematoma
- Damage to Surrounding Structures
  - •Recurrent Laryngeal Nerve Injury
  - •Parathyroid Gland Damage
- Scarring and Cosmetic Issues
- •Thyroid Hormone Imbalance
- Recurrence of Nodules
- Psychological Impact
- Cost and Recovery Time

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What's new? Thyroid and Artificial intelligence MITT (minimal invasive Thyroid Treatment)/Minimal invasive surgery)

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### MITT

 Endoscopic Thyroidectomy Robotic-Assisted Thyroidectomy •Transoral Thyroidectomy Percutaneous Radiofrequency Ablation (RFA) Laser Ablation •Ethanol Ablation •Microwave Ablation (MWA) •Ultrasound-Guided Biopsy and Ablation Endoscopic Thyroid Lobectomy Minimally Invasive Parathyroidectomy •Radioactive lodine (RAI) Therapy •Thyroid Nodule Cryoablation

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## What is **RFA**

- RFA is a minimally invasive procedure used to treat tumors and abnormal tissues.
- It utilizes high-frequency alternating current (200-1200 kHz) to generate thermal energy.
- Commonly applied in liver malignancies, thyroid nodules, and other solid tumors.
- Safe and effective alternative to surgery for certain benign and malignant conditions.

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# Step-by-step Procedure of RFA

### RFA: No Surger ! No Scar! Just A Needle!

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Table 9.	Table 9. Efficacy of RFA for Nonfunctioning Thyroid Nodules								•
Number	Authors	Sample Size (Nodule Number)	Follow Up Period (Months)	Symptom Score at Baseline	Symptom Score after RFA	Cosmetic Score at Baseline	Nodule Volume at Baseline (mL)	Nodule Volume after Treatment (mL)	VRR (%)
1	Ahn et al. (99)	22 (22)	3.6	NA	NA	NA	14.3	4.7	74.3
2	Aysan et al. (125)	100 (100)	15.4	NA	NA	NA	16.9	2.6	84.6
3	Baek et al. (9)	15 (15)	6.43	3.33	1	3.6	7.5	1.3	82.7
4	Baek et al. (126)	200 (200)	5.21	NA	NA	NA	6.8	1.8	73.2
5	Baek et al. (107)	22 (22)	6	2.9	0.2	3.8	8.6	1.1	87.5
6	Bernardi et al. (57)	37 (37)	12	NA	NA	NA	12.4	3.91	68.4
7	Cesareo et al. (117)	42 (42)	6	2.8	0.4	2.6	24.5	8.6	64.9
8	Che et al. (58)	200 (200)	12	NA	NA	NA	5.4	0.4	84.8
9	Deandrea et al. (132)	40 (40)	6	3.6	0.4	3.6	15.1	4.2	71
10	Hong et al. (101)	18 (18)	18.1	2.4	1.4	3.8	24.4	6.3	74.2
11	Huh et al. (110)	30 (30)	6	5.4	2.1	3.8	13.2	3.4	74.3
12	Jeong et al. (5)	302 (302)	NA	NA	NA	NA	6.13	1.12	84.1
13	Kim et al. (129)	73 (75)	11.5	3.97	1.84	NA	17	б	69.7
14	Kim et al. (6)	35 (35)	6.4	3.4	1.83	NA	6.31	0.74	88.2
15	Li et al. (127)	35 (35)	6	NA	NA	NA	8.81	1.59	82

 Table 2. VRR of RFA of benign thyroid nodules during follow-up

Follow-up length	Overall follow-up nodules* (n = 267)	Overall VRR, %	Multi-session RFA nodules* (n = 87)	Multi-session RFA VRR, %	Single-session RFA nodules* (n = 180)	Single-session RFA VRR, %
<1 yr	265	67.7 (52.7, 82.1)	86	64.5 (52.6, 79.4)	179	68.8 (52.8, 82.9)
1 yr	159	82.5 (69.0, 94.5)	66	80.7 (67.2, 93.2)	93	83.1 (72.7, 94.5)
2 yrs	123	90.7 (82.0, 97.8)	57	89.1 (82.1, 96.6)	66	91.1 (82.0, 98.5)
3 yrs	91	94.3 (85.7, 99.2)	45	90.7 (85.6, 96.9)	46	96.4 (87.4, 100)
4 yrs	75	95.4 (87.9, 100)	37	95.6 (90.0, 99.4)	38	95.1 (87.0, 100)
5 yrs	46	96.2 (91.2, 100)	24	97.5 (90.6, 100)	22	95.8 (91.6, 100)
6 yrs	47	97.5 (91.3, 100)	23	98.2 (90.5, 100)	24	96.4 (91.6, 100)
7 yrs	35	97.8 (92.9, 100)	14	94.3 (89.2, 97.4)	21	100 (95.3, 100)
8 yrs	28	96.5 (93.5, 99.8)	15	96.4 (94.5, 97.3)	13	100 (89.4, 100)
9 yrs	23	99.8 (93.9, 100)	12	97.7 (91.0, 99.8)	11	100 (98.5, 100)
≥10 yrs	32	100 (94.7, 100)	14	100 (94.6, 100)	18	98.8 (95.1, 100)

Data are median (interquartile range).

\*Number of nodules.

VRR = volume reduction rates, RFA = radiofrequency ablation

# Long Term outcome RFA

Study	Follow-Up Duration	Volume Reduction Rate	Complete Disappearance Rate	Recurrence Rate	Complication Rate
Ten-Year Outcomes Study	Median 133 months	99.9%	91.9%	Not specified	7.7% (transient voice changes)
Systematic Review & Meta- Analysis	≥24 months	95.03%	92%	6%	5%
Longer-Term Outcomes Study	Mean 80 months	99.5%	91.3%	Not specified	None renormed to the second seco



**Complications and Their** Management **Major Complications** Voice change (hoarseness) – 0.94– 1.6% Nodule rupture – 0.3–1.2% Significant hematoma – 0.2–0.5% Severe skin burn - < 0.1%

**Minor Complications** 

Pain – 2.5–4%

Minor hematoma – 1–2% Transient thyrotoxicosis – <1% Mild skin burn - < 0.5%Infection - < 0.2%Cough/vasovagal reaction – <1%

# **Benefit of RFA over Surgery**

Parameter

Invasiveness

Anesthesia Hospital Stay

Procedure Time

**Recovery Time** 

**Scar Formation** 

**Complication Rate** 

Preservation of Thyroid Function

Cost (Korea Data)

**Cosmetic Satisfaction** 

**Re-intervention Option** 

**Radiofrequency Ablation (RFA)** 

Minimally invasive (needle-based) Local anesthesia Outpatient or same-day discharge ~30–60 minutes 1–2 days No visible scar (US-guided) ~3.3% (major: <1.5%)

>95% preserve normal function

Lower total cost

Very high

Repeatable RFA possible if regrowth

Surgery (Lobectomy or Total Thyroidectomy) Invasive (incision, general anesthesia) General anesthesia 2–5 days hospitalization 1.5–2.5 hours 2–3 weeks

Visible neck scar

nerve injury) 20–50% require lifelong thyroxine replacement

11–15% (including hypocalcemia,

Higher due to OR, anesthesia, inpatient care

Moderate to low (due to scar)

Limited (once removed, no

# **RFA vs Microwave ablation**

### Parameter

Mechanism

**Device Control** 

**Heat Propagation** 

**Ablation Volume** 

Technique Standardization

Volume Reduction Rate (12 mo)

**Complication Rate** 

**Nerve Injury Risk** 

**Equipment Availability** 

Cost (Korea)

### Radiofrequency Ablation (RFA)

Ionic agitation via alternating current Precise, temperature-sensitive

Slower, controlled

Smaller per shot, requires moving-shot technique

Well-established moving-shot technique

~80-85%

~3.3% (major <1.5%)

Lower due to slow, controlled heating Widely available, more clinical experience Moderate (well established)

Extensive clinical guidance and training

### **Microwave Ablation (MWA)**

Dielectric heating via microwave energy Rapid and deep heating, less precise control Faster, may affect surrounding tissue Larger per shot, more aggressive heating Lacks standardized technique for thyroid use ~75–83% (comparable, slightly variable) Similar or slightly higher (~3–5% in some studies) Higher if not carefully monitored Less widespread in thyroid centers Similar or slightly higher due to newer technology Shorter learning curve, but lacks thyroid-

### **RFA vs Laser**

Parameter

Mechanism

Needle Type

**Ablation Control** 

Standardization

Volume Reduction Rate (12 mo)

Energy Delivery Complication Rate Cosmetic Outcome Pain During Procedure Procedure Time Post-procedure Recovery Availability in Korea **Radiofrequency Ablation (RFA)** 

Frictional heat from high-frequency current

Internally cooled electrode (18G)

Moving-shot technique (precise targeting)

Well-established for thyroid nodules

~80–85%

Real-time, dynamic control ~3.3% total (major <1.5%) Excellent (no scar) Mild, manageable with local anesthesia ~30–60 minutes 1–2 days Widely used, first-line option

#### Laser Ablation (LA)

Coagulative necrosis from laser light energy Thin optical fibers (21G introducer needle) Fixed-fiber pullback or multi-fiber technique Less standardized for large or complex nodules ~50–75% (variable by nodule size & energy used) Fixed, pulsed energy via fibers ~2–4% (mostly minor) Excellent (no scar) Mild, similar to RFA ~20–40 minutes 1–2 days Less common, used in selected centers

# **Role of RFA in Other disorder**

### Disorder

**AFTN (Autonomous Functional Thyroid Nodules)** 

**Volume reduction**: ~75–85% after 12 months. - **TSH normalization**: Achieved in ~90% of cases.

**Recurrent Thyroid Cancer** 

Hyperparathyroidism (HP)

## **Contraindications and Cautions**

No Absolute Contraindications

•Patient disagree

•No biopsy report

Relative Contraindications

•Heavy intranodular calcification

Inadequate benign cytology confirmation

•Nodules abutting critical structures ("danger zones")

•Severe coagulopathy or bleeding diathesis

Special Situations Requiring Modification

•Pregnancy (use of bipolar electrodes)

•Patients with cardiac pacemakers or implanted devices

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## **Equipment of RFA**

- **1. RFA Generator (Radiofrequency Generator)**
- **2.** Electrodes (RF Needles or Probes)
- **3. Grounding Pads (Return Electrodes)**
- 4. Ultrasound Machine or Imaging Guidance
- 5. Cooling System (for Internally Cooled Electrodes)
- 6. Thermocouples or Temperature Monitoring System (optional)
- 7. Foot Pedal (optional)
- 8. Sterile Consumables and Accessories

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#### A GUIDEBOOK ON RADIOFREQUENCY ABLATION FOR THYROID AND NECK TUMOR

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Dr. Back









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### **1 Year After** STARmed RFA Procedure

Before STARmed RFA Procedure

6 Months After STARmed RFA Procedure









### Jung Hwan Baek May 1, 2024 · 🚱

Follow-up posting (See 2023-9-26 and 2023-11-6 posting). M/85, inoperable primary thyroid cancer involving skin. It was successfully treated in Asan Medical Center (by Dr. Chung Sae Rom and Dr. Jung Hwan Baek). Before RFA, large calcified mass with huge hemorrhage involving skin. After RFA, large bleeding from the tumor was successfully removed. 1-month after RFA small skin scar is remained, but successfully treated skin involving PTC. 6-month followup, we performed additio... See more



### M/68, Huge primary thyroid cancer

 Inoperable status due to Cardiac problem (AF)
 Cerebral infarction







Jung Hwan Baek October 30, 2023 · 🕥

RFA of intrathoracic goiter. Markedly decreased size of goiter (2-year FU) with upward moving after 2-sessions of RFA (step-by-step ablation). We used perfusion electrode (wet electrode). Perfusion electrode can achieve larger ablation zone with lower pain sense. (Int J Hyperthermia. 2022;39(1):573-578. Thyroid-dedicated internally-cooled wet electrode for benign thyroid nodules: experimental and clinical study)



# **Conclusion & Acknowledgment**

• Thanks Asan Medical Center for the opportunity



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# Key messages(RFA)

- Minimal Invasive
- Very Effective
- Alternative to surgery
- Safe and Low complication and Low Cost
- Phisible to start it In Bangladesh(SKH)
## Requirements for Thyroid RFA Service:

- One ultrasound (USG) machine
- One radiofrequency ablation (RFA) generator
- Disposable RFA probe (to be paid by the patient)
- An OT setup or procedure room equipped with a cardiac monitor
- Coordination with the **Pathology Department** for **USG-guided FNAC**:
  - We are capable of performing the FNAC procedure ourselves.
  - The Pathology Department will be responsible only for **cytological interpretation**.





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