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পিও আন হাসায়ো

জোনা চিমিম নিদা

Radiofrequency Ablation for Thyroid Tumors: A New Era Begins in Bangladesh

Principle of Radio Frequency Ablation

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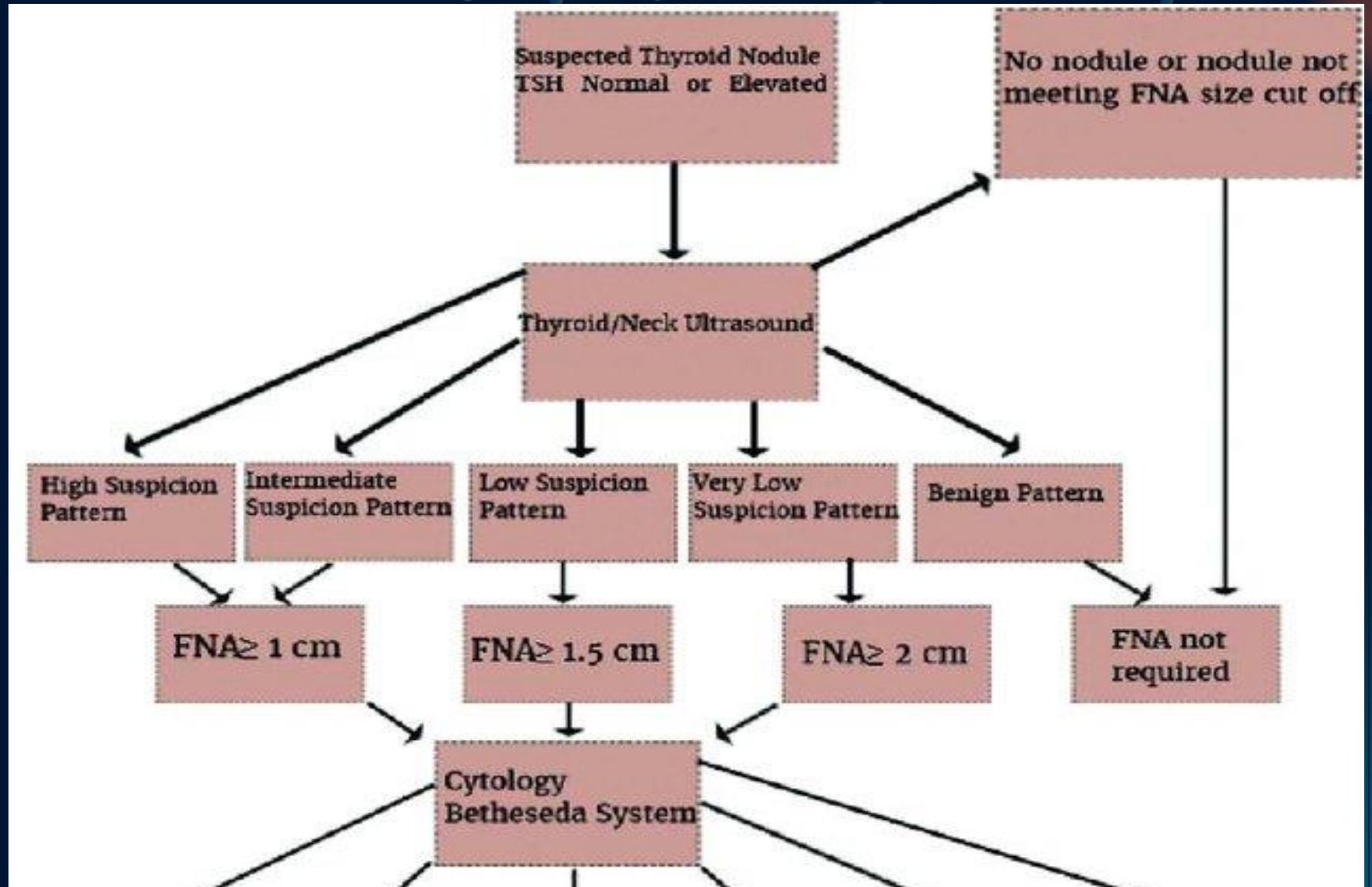
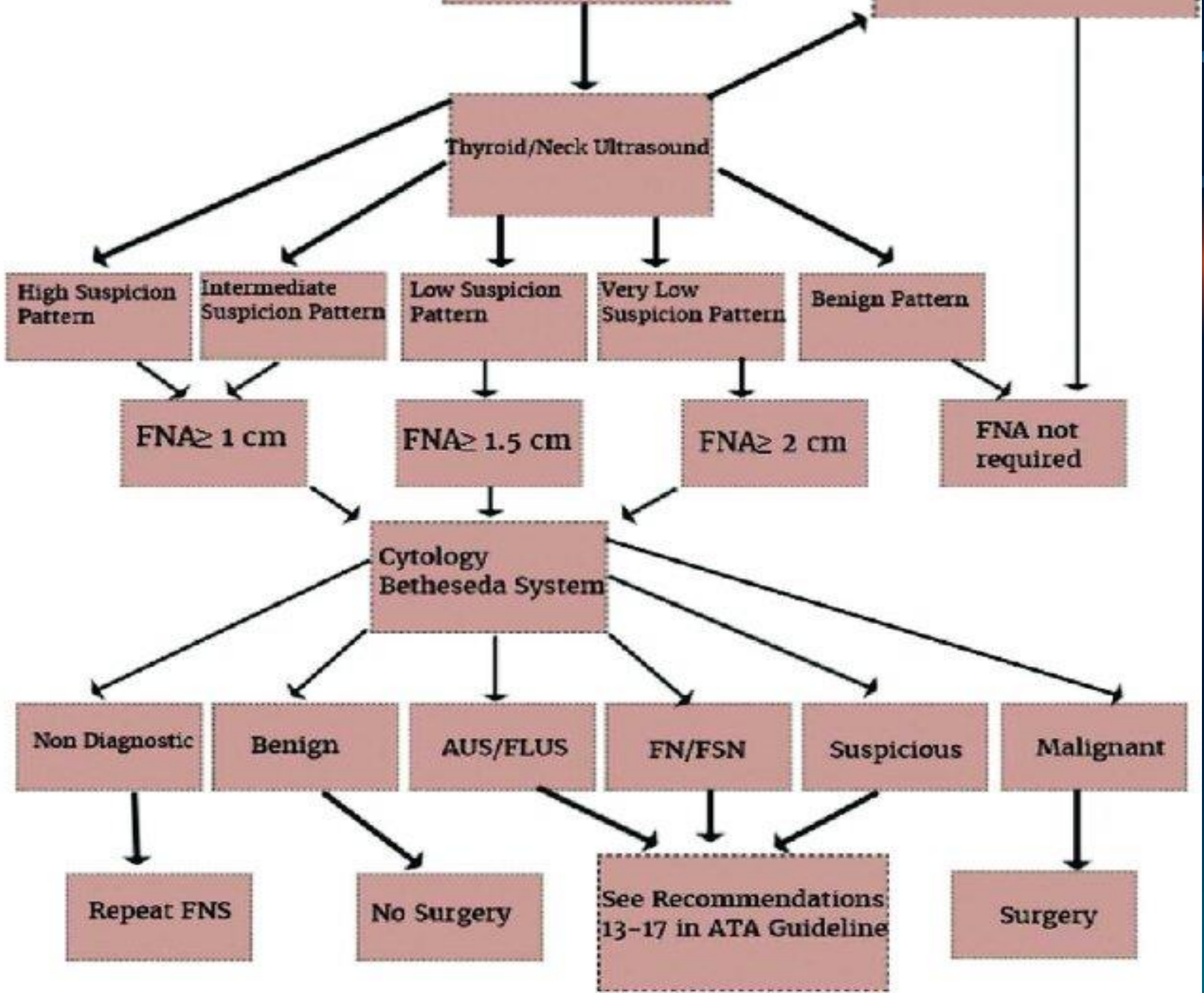
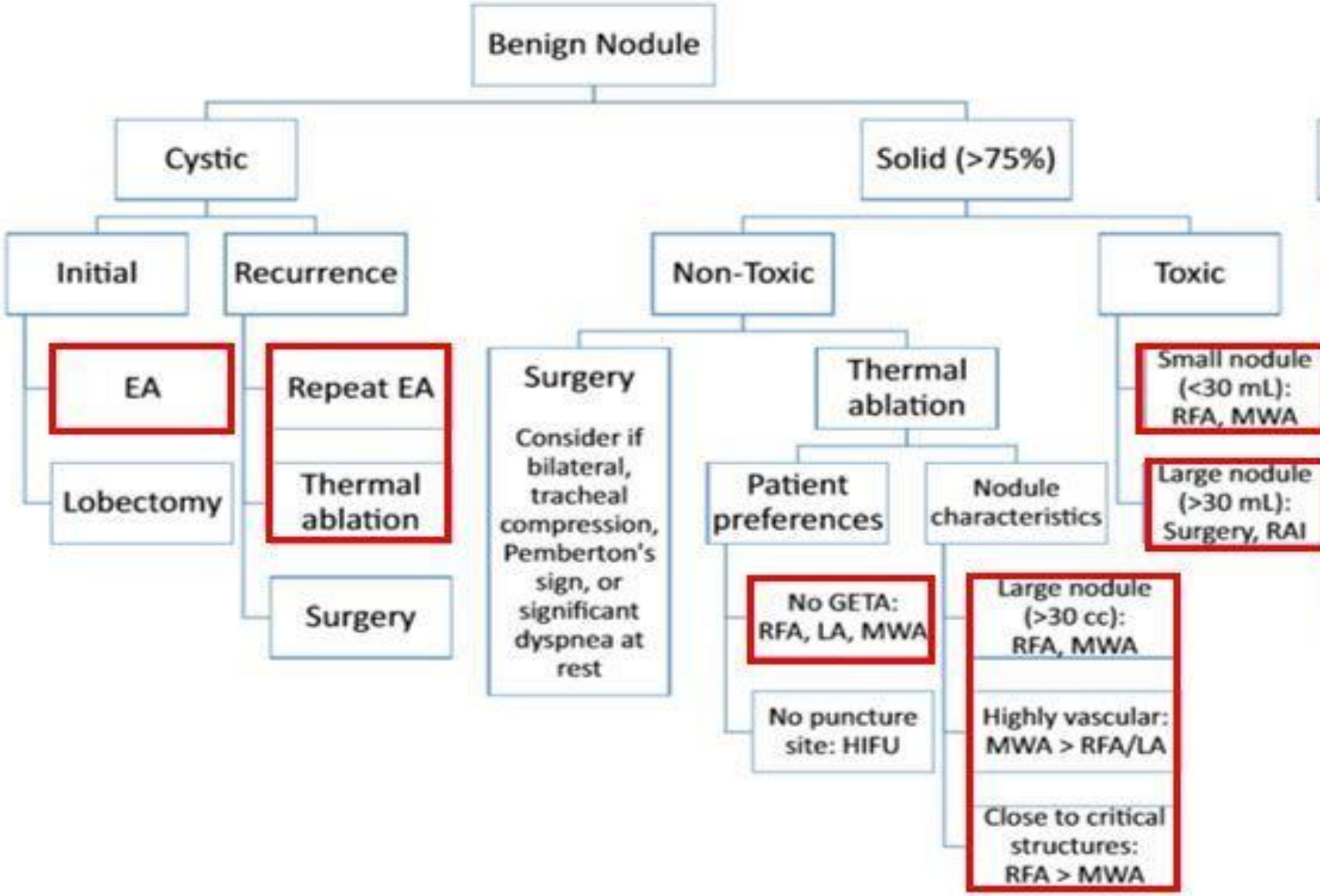
Traditional guideline of Thyroid Nodule Approach

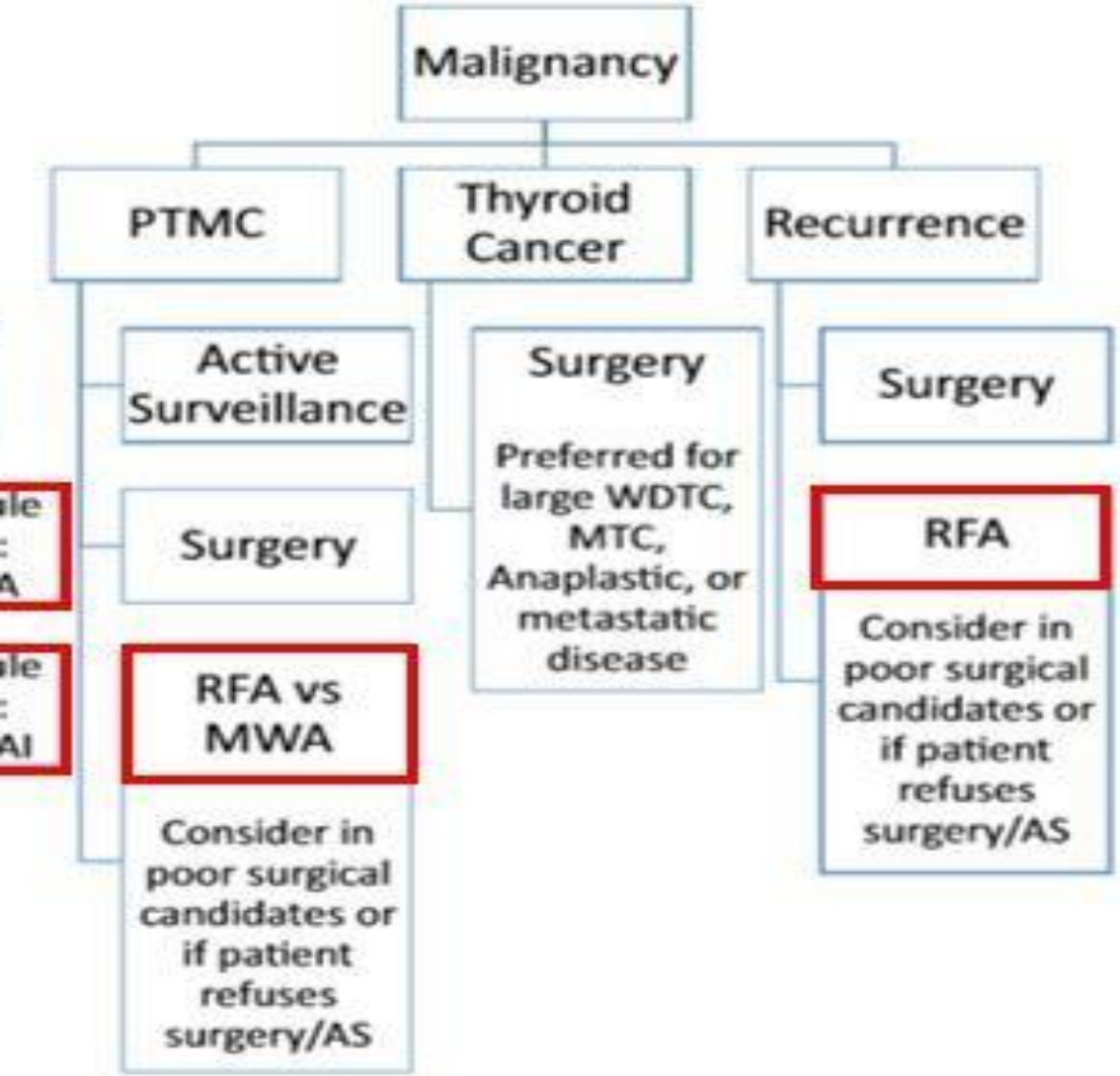


Current guideline of Tyroid Nodule Approach



Updated Guideline of Thyroid Nodule Approach(KJR)





Updated Guideline of Thyroid Nodule Approach(KJR)

Introduction to Thyroid Nodules

- What is Nodule: Over growth of tissue in thyroid

- Nodule vs Tumour ?
  - smaller and less likely malignant vs larger and higher potential for malignancy.
  - Most are benign; malignancy rate ≈ 5–15% vs Higher risk of malignancy or already malignant,

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Epidemiology:

Detection Method	Prevalence
Clinical palpation	~4%–7% of the adult population
Ultrasound (Sonography)	~19%–68%, depending on age, sex, iodine status
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.

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

Traditional choice of Treatment: Surgery

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**

What's new? Thyroid and Artificial intelligence

MITT (minimal invasive Thyroid Treatment)/Minimal invasive surgery)

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- 2700 bed
- 15000/day in OPD
- 7200/year surgery
- Best success rate organ transplantation
- Highest technology for cancer treatment

Busan, S. Korea

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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 Iodine (RAI) Therapy
- Thyroid Nodule Cryoablation

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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Mechanism of RFA

Alternating electric current

↓

Ionic agitation

↓

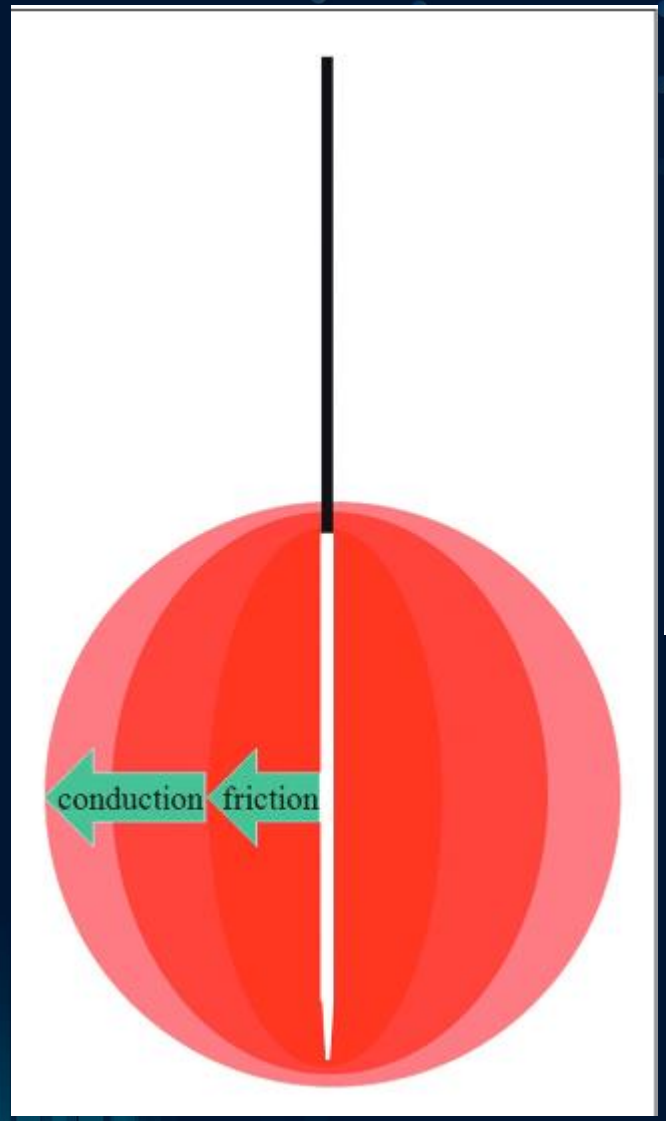
Frictional heat

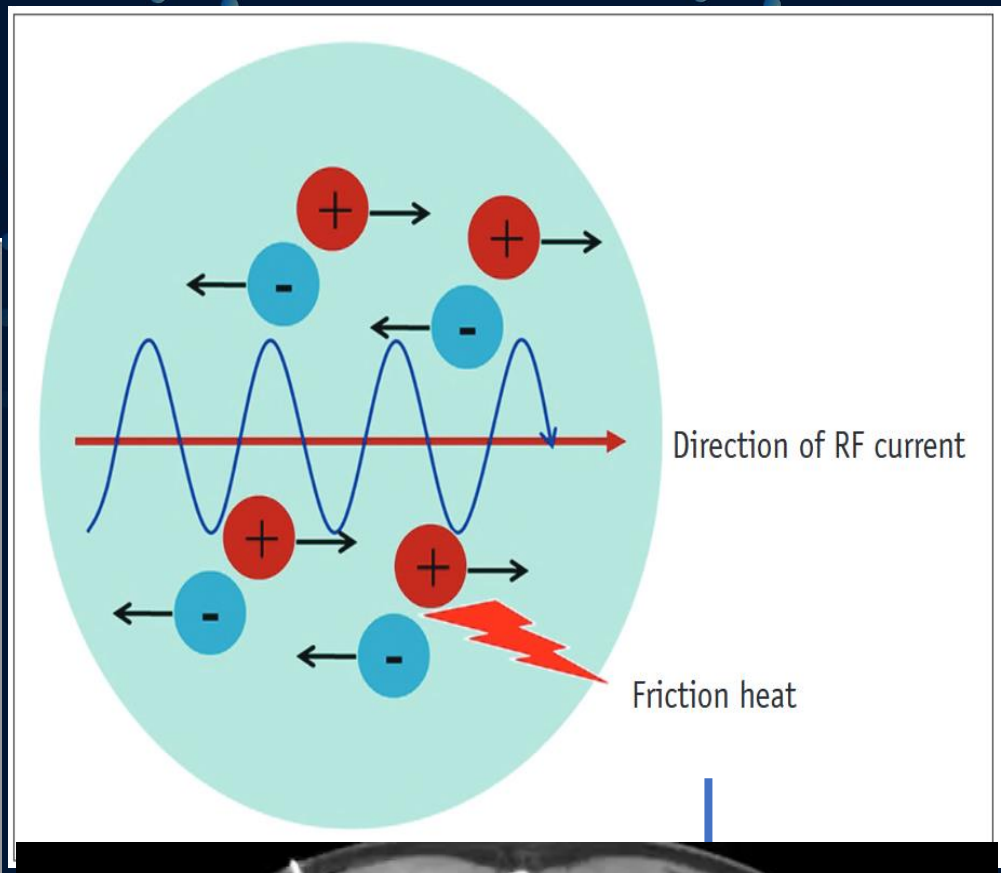
↓

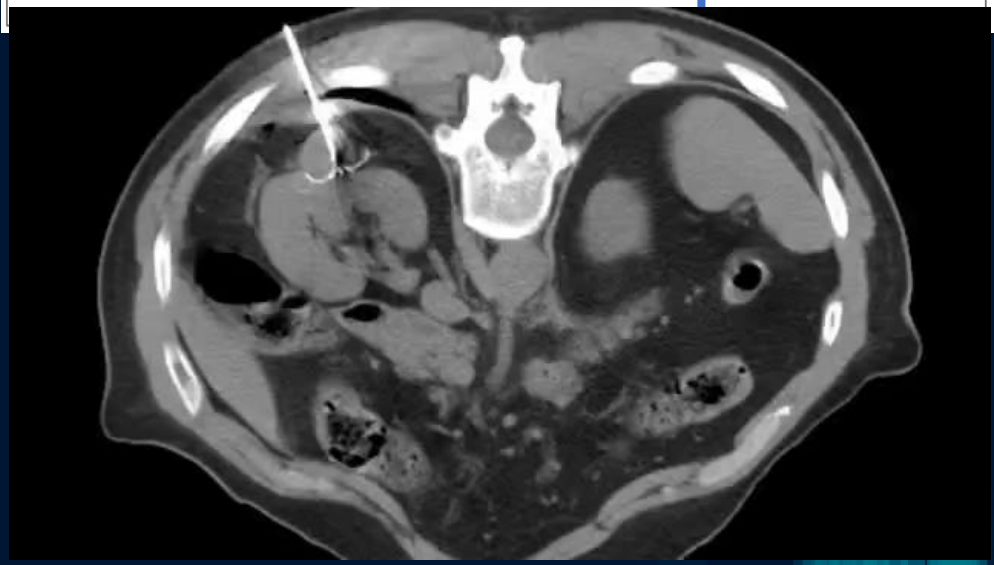
Thermal damage
Coagulation necrosis.

↓

Heat is transferred through conduction.







Step-by-step Procedure of RFA

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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

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%

Post-procedure Care and Follow-up

Post-procedure Care

- Immediate Observation (0–1 hour)
  - Pain and Discomfort Management
  - Wound and Local Care
  - Discharge Instructions

Follow-up Schedule

- Early Follow-up (1 Month)
  - Intermediate Follow-up (3 and 6 Months)
  - Long-term Follow-up (12 Months and Beyond)

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	6	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

Benefit of RFA over Surgery

Parameter	Radiofrequency Ablation (RFA)	Surgery (Lobectomy or Total Thyroidectomy)
Invasiveness	Minimally invasive (needle-based)	Invasive (incision, general anesthesia)
Anesthesia	Local anesthesia	General anesthesia
Hospital Stay	Outpatient or same-day discharge	2–5 days hospitalization
Procedure Time	~30–60 minutes	1.5–2.5 hours
Recovery Time	1–2 days	2–3 weeks
Scar Formation	No visible scar (US-guided)	Visible neck scar
Complication Rate	~3.3% (major: <1.5%)	11–15% (including hypocalcemia, nerve injury)
Preservation of Thyroid Function	>95% preserve normal function	20–50% require lifelong thyroxine replacement
Cost (Korea Data)	Lower total cost	Higher due to OR, anesthesia, inpatient care
Cosmetic Satisfaction	Very high	Moderate to low (due to scar)
Re-intervention Option	Repeatable RFA possible if regrowth	Limited (once removed, no regrowth possible)

RFA vs Microwave ablation

Parameter	Radiofrequency Ablation (RFA)	Microwave Ablation (MWA)
Mechanism	Ionic agitation via alternating current	Dielectric heating via microwave energy
Device Control	Precise, temperature-sensitive	Rapid and deep heating, less precise control
Heat Propagation	Slower, controlled	Faster, may affect surrounding tissue
Ablation Volume	Smaller per shot, requires moving-shot technique	Larger per shot, more aggressive heating
Technique Standardization	Well-established moving-shot technique	Lacks standardized technique for thyroid use
Volume Reduction Rate (12 mo)	~80–85%	~75–83% (comparable, slightly variable)
Complication Rate	~3.3% (major <1.5%)	Similar or slightly higher (~3–5% in some studies)
Nerve Injury Risk	Lower due to slow, controlled heating	Higher if not carefully monitored
Equipment Availability	Widely available, more clinical experience	Less widespread in thyroid centers
Cost (Korea)	Moderate (well established)	Similar or slightly higher due to newer technology
	Extensive clinical guidance and training	Shorter learning curve, but lacks thyroid-

RFA vs Laser

Parameter	Radiofrequency Ablation (RFA)	Laser Ablation (LA)
Mechanism	Frictional heat from high-frequency current	Coagulative necrosis from laser light energy
Needle Type	Internally cooled electrode (18G)	Thin optical fibers (21G introducer needle)
Ablation Control	Moving-shot technique (precise targeting)	Fixed-fiber pullback or multi-fiber technique
Standardization	Well-established for thyroid nodules	Less standardized for large or complex nodules
Volume Reduction Rate (12 mo)	~80–85%	~50–75% (variable by nodule size & energy used)
Energy Delivery	Real-time, dynamic control	Fixed, pulsed energy via fibers
Complication Rate	~3.3% total (major <1.5%)	~2–4% (mostly minor)
Cosmetic Outcome	Excellent (no scar)	Excellent (no scar)
Pain During Procedure	Mild, manageable with local anesthesia	Mild, similar to RFA
Procedure Time	~30–60 minutes	~20–40 minutes
Post-procedure Recovery	1–2 days	1–2 days
Availability in Korea	Widely used, first-line option	Less common, used in selected centers

Role of RFA in Other disorder

Disorder	Role of RFA	Clinical Data & Outcomes (Korean & European Studies)
AFTN (Autonomous Functional Thyroid Nodules)	- RFA is a first-line treatment for **non-toxic, non-surgical candidates**. - RFA reduces **symptoms** of hyperthyroidism and **nodular size**.	- **Volume reduction**: ~75–85% after 12 months. - **TSH normalization**: Achieved in ~90% of cases. - **Symptom relief**: Over **80%** of patients report significant improvement in hyperthyroid symptoms (European Society of Endocrinology, 2020).
Recurrent Thyroid Cancer	- RFA offers a **non-surgical approach** to manage **local recurrence** of thyroid cancer after initial surgery.	- **Local control** rate: ~70–85% for **nodules ≤1.5 cm**. - For **small** recurrent papillary thyroid cancer, **RFA** has shown similar efficacy to surgery with **lower complication rates**. (KJR, 2019). - **Survival rates** are comparable to those of surgery for select recurrent cases (European Thyroid Association, 2021).
Hyperparathyroidism (HP)	- RFA is an alternative to **parathyroidectomy** for **adenomas**, especially in cases of **secondary hyperparathyroidism** in renal failure patients.	- **PTH reduction**: Reduction in **PTH levels** by 60–70% post-RFA in secondary hyperparathyroidism patients. - **Success rate**: ~70–85% in symptom resolution. - RFA has shown a **lower complication rate** compared to surgery in patients with **end-stage renal disease** (European Journal of Endocrinology, 2020).

Mechanism of 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 reported

Contraindications and Cautions

- **No Absolute Contraindications**
  - Lack of any outright “no-go” criteria in current guidelines
  - Emphasis on appropriate case selection and technique
- **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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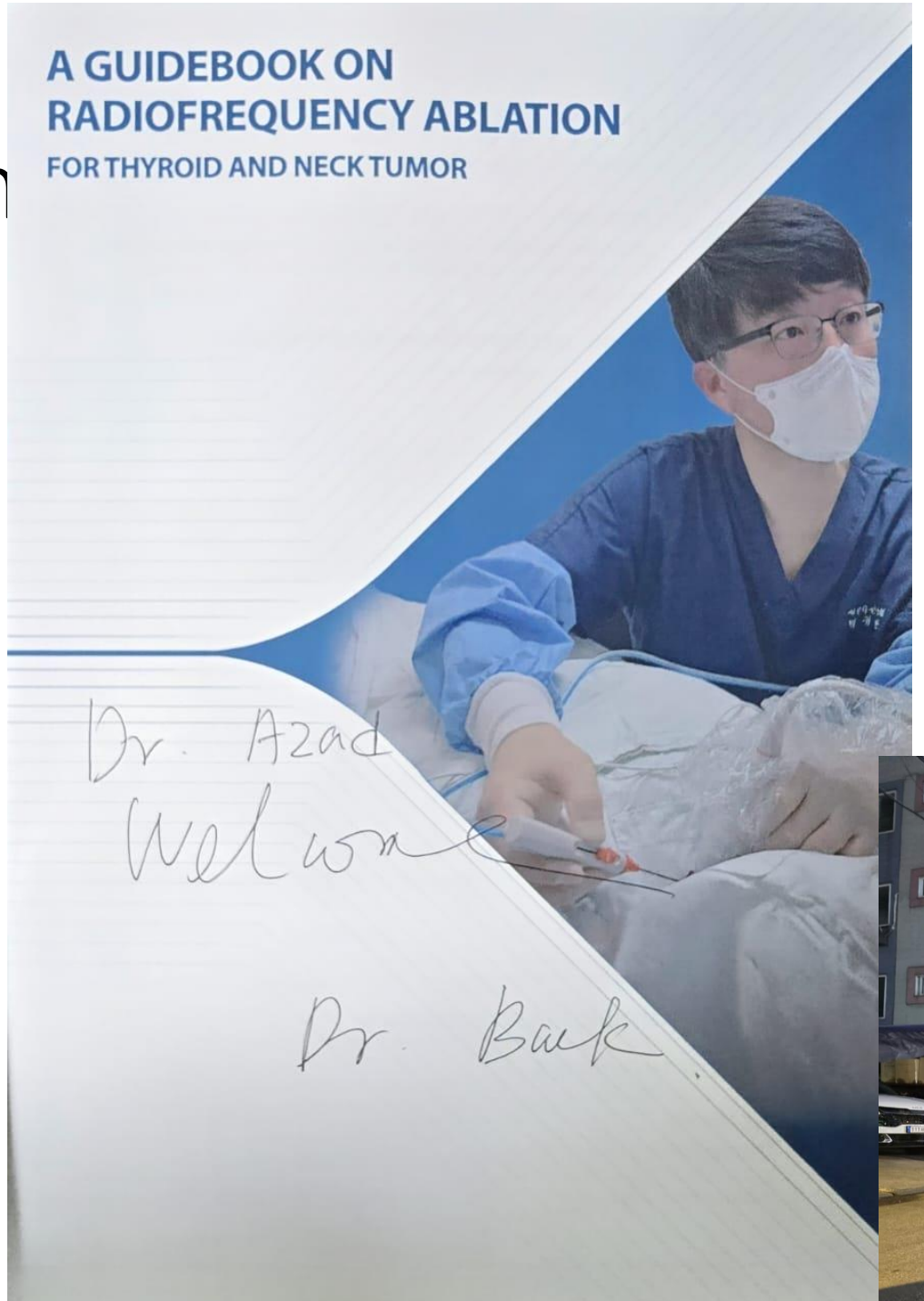
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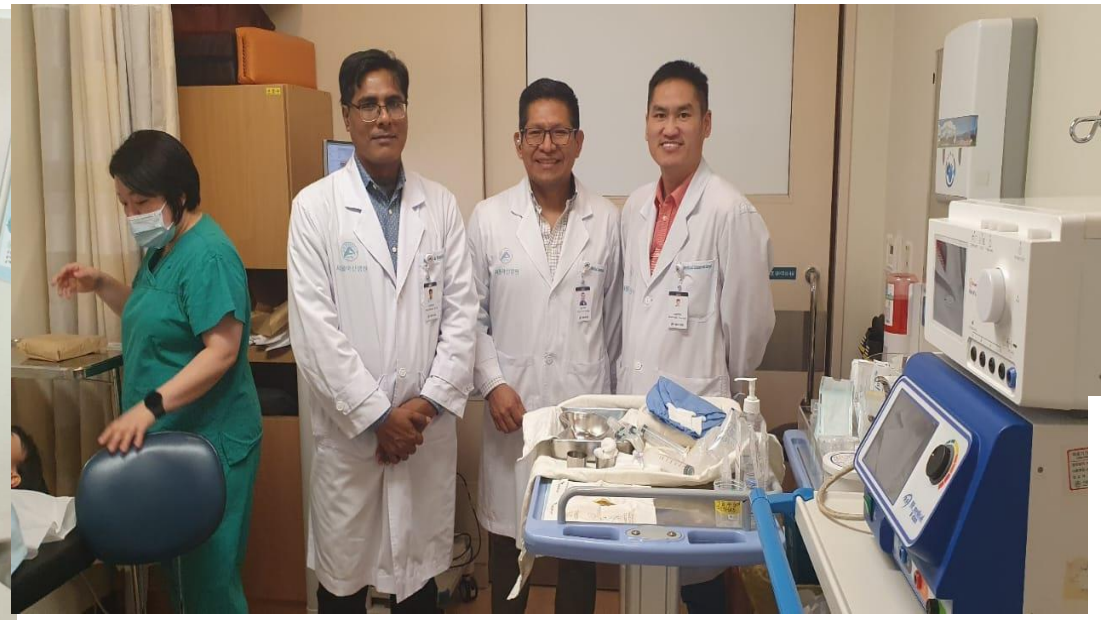
RADIOFREQUENCY ABLATION
FOR THYROID AND NECK TUMOR
Dr. Azad
Welcome
Dr. Baek



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Thyroid Nodule Treatment Modalities
maximize the nodular volume reduction ratio (VRR)
minimize complications
RFA
PLA
Ethanol
Surgery


Product
Development
History

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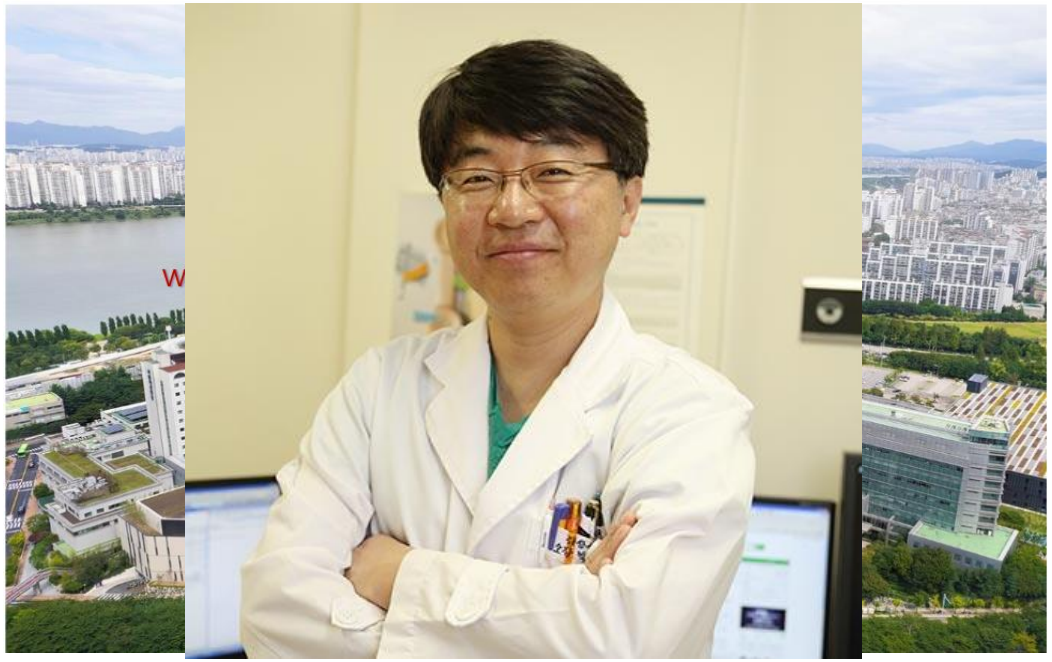
Conclusion & Acknowledgment

- Thanks Asan Medical Center for the opportunity



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