

General Principles for the Safe Performance, Training, and Adoption of Ablation Techniques for Benign Thyroid nodules: An ATA[®] Statement

Peri-procedural Considerations

Ethanol Ablation

- Aspiration of the cyst under ultrasound visualization with an appropriate gauge needle depending on cyst fluid viscosity
 - 16-25 gauge needle
 - Trans-isthmic approach may prevent extravasation
- Without removing needle, slowly inject ethanol 95-99% into the space to about 30-50% of the original cyst volume
 - Consider a saline flush/aspiration prior to ethanol injection
 - Maintain ultrasound visualization during ethanol injection
 - Pain or burning may indicate extravasation

Radiofrequency Ablation (RFA) Equipment

- The RFA generator provides 5-80 W continuous power and there are monopolar and bipolar electrodes of variable length with active tips of varying size
 - All RFA procedures are performed under US guidance (linear array, 7-14 MHz frequency)
 - Monopolar electrodes require a grounding pad and should not be used in the setting of pregnancy or implanted electrical devices
 - Selection of wattage and electrode length and active tip size is nodule and operator dependent
 - Active tip size influences RF power:

<i>RF power (W)</i>	<i>Active tip size (cm)</i>
RF power according to active tip size	
5-15	0.38
10-30	0.5
20-40	0.7
30-80	1.0
50-90	1.5

Ablation Peri-procedural Checklist

- *Equipment and Technical Considerations*

- Active tip size chosen based on nodule size/volume
- Generator and pump checked and working
- Optimal energy to be delivered to nodule calculated based on nodule volume (optional)
- Starting power chosen based on active tip size and nodule characteristics
- Cold saline available in fridge in adequate amounts for electrode cooling (RFA)
- Anxiolytic medication taken by patient if required

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- *Patient and Ablation Approach Considerations*

- Consent signed
- Nodule ablation location confirmed with patient
- Patient re-counseled regarding normal versus abnormal expectations and symptoms during the procedure
- All disposable equipment available, including cold dextrose 5% for hydrodissection off critical structure and for injection in case of laryngeal nerve injury, sterile ultrasound probe covers
- Maximal safe volume of local anesthetic calculated by patient body weight and type of anesthetic used (most commonly 1% lidocaine)
- Patient positioned with neck extended
- Neural structures (vagus, MSG), carotid sheath, and neck viscera visualized; need for hydrodissection off nodule determined
- Danger zones identified
- Entry angle of technique applicator to skin determined based on nodule size and location in thyroid; anterior neck veins identified on ultrasound

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Anesthesia

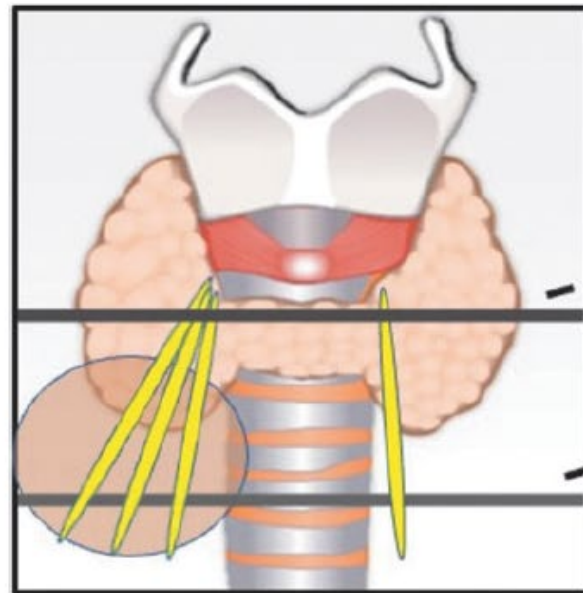
- There are advantages to different anesthetic approaches:
 - Local anesthesia allows the patient to vocalize during the procedure
 - Conscious sedation may decrease anxiety and discomfort but prevent early recognition of complications
- Local anesthetic is provided in a stepwise fashion:
 - Subcutaneous injection in the midline
 - Needle is then passed through anesthetized skin and deep to strap muscles to inject lidocaine 1% around the thyroid capsule
- Patient weight should be used to calculate maximal lidocaine dose to avoid dangers associated with lidocaine toxicity (utilize dose < 4.5 mg/kg of 1% lidocaine)

RFA Technique

- RFA electrode should be passed through the thyroid isthmus into the nodule (trans-isthmic approach)
 - Allows visualization of electrode, nodule and location of recurrent laryngeal nerve
 - Normal intervening thyroid tissue prevents extravasation of hot fluid
 - Electrode position remains stable even with speech/swallowing
- Moving-shot technique should be utilized
 - Active tip of electrode is placed in deepest portion of nodule and subsequently withdrawn to treat more superficial areas
 - This technique prevents limitation of US visualization by gas bubbles generated from treatment effect

Avoid Ablation in “Danger Triangle” or “Danger Zone”

FIG. 2. The danger triangle concept is applicable to ablation at the level of the upper tracheal rings and cricothyroid joint. In the lower neck, the concept of a “danger zone” is more appropriate as the recurrent laryngeal nerve is often laterally placed at these levels, especially on the right. CCA, common carotid artery; TR, trachea.



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Managing Acute Complications

- Pain during the procedure may indicate damage to critical structures as thyroid parenchyma is mostly insensate
- If hoarseness or coughing occurs, the procedure should be stopped immediately
 - Injection of a bolus of cold D5W at the site where hoarseness occurred may help dissipate heat
- Hemorrhage is typically self-limited with application of pressure but occasionally requires thermal ablation of a small vessel or endovascular/surgical intervention and urgent control of airway for profuse bleeding or expanding hematoma