The Five "B's" for Successful Thyroid Nodule Radio-Frequency Ablation

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Introduction

While conventional thyroidectomy is still considered the first-line intervention for malignant or compressive thyroid nodules, patients with symptomatic benign thyroid nodules can undergo radiofrequency ablation (RFA) while avoiding surgery. Studies evaluating RFA as treatment for benign thyroid nodules have demonstrated greater symptomatic and cosmetic relief when compared to conventional thyroidectomies. Furthermore, operation time, hospital stay, and postoperative complications (i.e. pain and hypothyroidism) are reduced among patients who underwent RFA [1]. Additionally, as of January 1, 2025, two new CPT codes governing thyroid RFA are available, allowing for greater treatment accessibility for both patients and physicians [2]. Moreover, there is potential for substantially greater savings with RFA due to its ability to be performed in an outpatient clinic as opposed to an OR [3]. Due to its increasing popularity and its demonstrated benefit for both clinical results and patient satisfaction, knowledge on how to efficiently perform the RFA maneuver is essential. Herein, we introduce "The Five B's for Successful Thyroid RFA" to guide interventionalists as they adopt this novel procedure.

Fig. 1

Radiofrequency Ablation

Radiofrequency ablation incorporates high temperatures to induce focal cellular apoptosis, and ultimately, coagulative necrosis. When a percutaneous probe is placed within the thyroid nodule, frictional heating occurs as ions within the tissue oscillate rapidly, attempting to align with the changing directions of the alternating high-frequency current. At temperatures from 60-100°C, proteins denature, cell membranes are disrupting, causing coagulative necrosis, which is the immediate response. A delayed inflammatory response contributes to the progressive shrinkage of the nodule, as the necrotic tissue is phagocytosed and resorbed, reducing nodule size and symptoms without surgery [4]. Thus, radiofrequency ablation allows for controlled tissue necrosis by utilizing high-frequency alternative currents to produce localized resistive heating.

How I do it?

Under ultrasound guidance, perithyroidal injections of 1% lidocaine with epinephrine are injected around the thyroid and the expected path of the RFA needle. A skin puncture is made with an 11 blade scalpel. The RFA probe is inserted, and ablation is carried out in serial fashion from deep to superficial and superior to inferior.

Why the five B's?

RFA for thyroid nodules is a relatively new procedure and many providers are not formally trained on the technique. Like any procedure, there is a learning curve. However, by remembering and using the "Five B's", providers ensure that they are minimizing complications and adequately treating the nodule to decrease its volume.

Bevel

The **bevel** or tip of the RFA needle is where the radiofrequency is concentrated and performs the ablation. Therefore, it is a critical first landmark to identify prior to ablating. Identifying the **bevel** and verifying it is within the thyroid nodule avoids accidental damage to surrounding structures. The red arrow in figure 2 shows the **bevel** of the RFA device within the thyroid nodule.

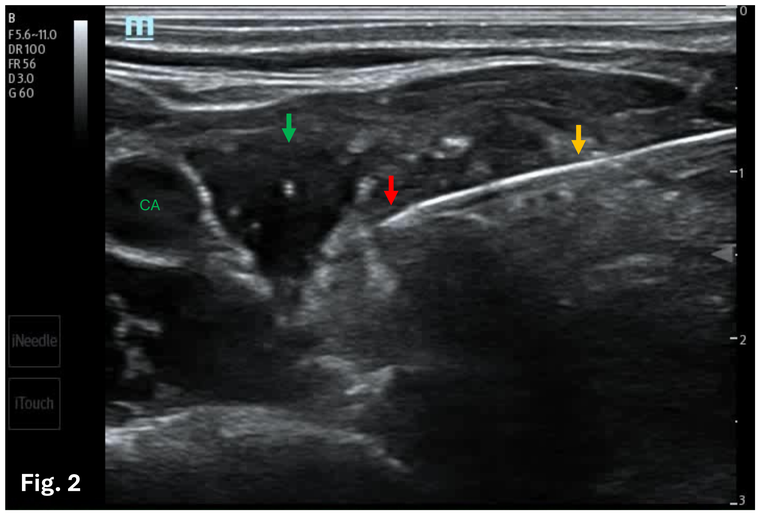

Fig. 2

Barrel

The **barrel** or shaft of the RFA device should be identified next. Ensure that you can see the entire length of the **barrel**. This verifies that your two-dimensional view on the ultra-sound is in fact aligned with the entire needle. The **barrel** is indicated in figure 2 with the yellow arrow.

Buffer

As the RFA is performed, it generates heat which can dissipate to surrounding structures. To ensure that surrounding structures like the common carotid artery and recurrent laryngeal nerve are not inadvertently damaged, a **buffer** is created via hydro-dissection near these structures. Check to ensure there is a **buffer** that will act as a heat sink during the ablation. The green arrow in figure 2 shows the **buffer** just medial to the common carotid artery (CA).

Bubbles

After clearly identifying the bevel, visualizing the entire barrel, and ensuring there is a buffer, you are ready to start the ablation. As you begin, you should see **bubbles** form at the bevel of your RFA device. The **bubbles** indicate that the tissue has reached the appropriate temperature to denature proteins within a 5-10mm radius. The bubbles are seen in figure 3 just at the tip of the bevel of the RFA device.

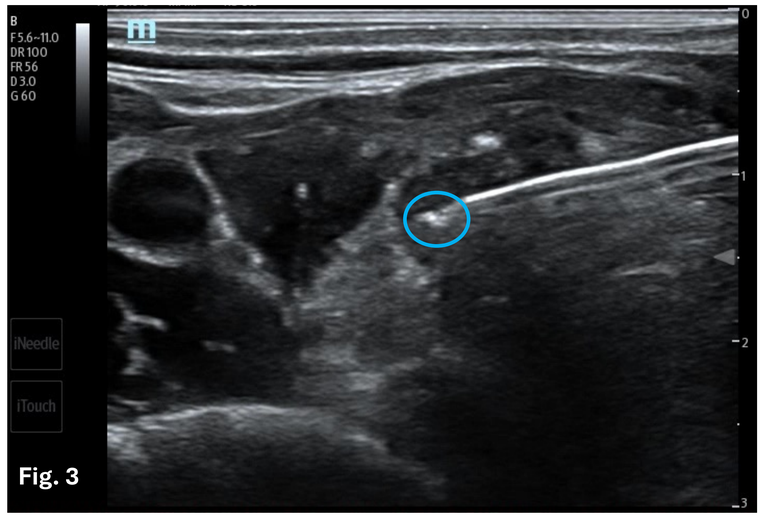

Fig. 3

Back

The RFA device is then retracted **back** to continue ablation throughout the thyroid nodule. You will continue to see a trail of bubbles form where the needle was previously pulled **back** from. The blue highlights and arrow in figure 4 demonstrate this finding.

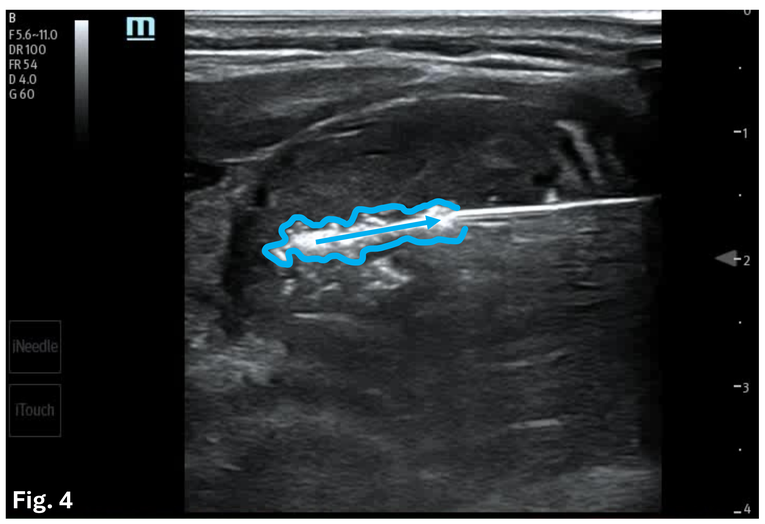

Fig. 4

Conclusion

RFA for benign symptomatic thyroid nodules is a novel procedure that can benefit many patients' seeking relief while avoiding surgery. Although many providers are not formally trained in the RFA technique, we have developed the "Five B's" to be used as guiding principles in conjunction with previously published RFA technique strategies [5]. Following these principles will help ensure a safe and effective thyroid nodule ablation.

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