Editorial

Radiofrequency ablation for primary hyperparathyroidism: are we there yet?

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Radiofrequency ablation (RFA) is a technology that has been used to treat solid tumors since the early 2000s. In this procedure, an electrode is inserted into the tumor and generates frictional heat that causes tissue coagulation and destruction, ultimately leading to volume reduction of the mass (1). In 2012, the Korean Society of Thyroid Radiology published guidelines for performing RFA for benign thyroid nodules. In order to use this technology in the neck, several safety modifications were described in the initial guidelines and are routinely practiced. These include the trans isthmic approach and the moving shot technique. The trans isthmic approach refers to the insertion of the electrode percutaneously through the isthmus of the thyroid from the side of the neck that is opposite the target nodule. This approach increases the distance between the active tip of the electrode and the skin and thereby decreases the chance of thermal cutaneous injury. Additionally, the positioning of the electrode in this fashion stabilizes it in the thyroid parenchyma and allows the operator to safely monitor the relationship of the active tip to the "danger triangle" where the recurrent laryngeal nerve runs in the tracheoesophageal groove. The moving shot technique allows the operator to systematically and effectively ablate the entire volume of the nodule while minimizing the risk of heat injury to surrounding structures (2). Another technique that has been developed since the initial 2012 guidelines that is discussed in the updated 2017 guidelines is hydrodissection. Hydrodissection involves the injection of 5% dextrose between the target lesion and surrounding structures that should be avoided, such as the recurrent laryngeal nerve, the trachea, or the carotid sheath. This technique creates a heat sink effect that blocks the thermal spread through the injected fluid (3).

Indications for RFA include symptomatic benign nodules, autonomously functioning nodules, or recurrent papillary thyroid carcinoma (2,3). Studies have demonstrated a reduction in volume ranging from 70–80% at 12 months post RFA and the majority of patients experience improvement in symptoms (4,5). Due to the promising results of RFA in benign and autonomously functioning nodules, the indications for RFA continue to expand. Regarding emerging indications, such as ablation of indeterminate thyroid nodules with benign molecular testing or micropapillary thyroid carcinoma, there must be extensive consideration of the feasibility and safety of RFA for that given indication and patients must be counseled that long-term data are limited.

Kandil *et al.* present a case of utilizing intraoperative parathyroid hormone (IOPTH) monitoring with RFA of an intrathyroidal parathyroid adenoma (6). The authors describe a 51-year-old woman with primary hyperparathyroidism who underwent a four-gland exploration and excision of two parathyroid glands without an appropriate drop in intraoperative PTH levels. Postoperatively, her calcium and PTH levels remained elevated, suggesting persistent disease, and a repeat

ultrasound demonstrated an intrathyroidal hypoechoic thyroid nodule. PTH washout confirmed that the lesion was an intrathyroidal parathyroid. Due to the increased risk associated with a re operative surgery, the patient wanted to pursue nonoperative management and RFA was offered. While several case reports explore the use of RFA in primary hyperparathyroidism, frequently among patients who are unable to or refuse to have an operation, use of RFA for primary hyperparathyroidism is not often considered because of the risk to the recurrent laryngeal nerve (7-10). Unlike thyroid nodules surrounded by thyroid parenchyma, the parathyroid glands in the typical location have no protective surrounding tissue to serve as a barrier between the tip of the electrode and the nerve, thus putting the recurrent laryngeal nerve at risk. As a result, hydrodissection is a crucial maneuver to allow for complete ablation of the parathyroid gland as well as to protect the recurrent laryngeal nerve. However, the intrathyroidal location of the parathyroid adenoma in the case presented lowers the risk to be equivalent to that associated with RFA of a thyroid nodule. The authors also introduce the novel technique of utilizing IOPTH monitoring that is used with surgical excision of the parathyroid gland. The authors successfully satisfied Miami criterion with a drop in PTH from 270 to 39 (>50% decrease at 10 minutes post ablation) (11).

The authors demonstrate several important take away points. First, a tool used for parathyroid surgery (IOPTH) can also be useful for RFA. The authors illustrate that RFA of a parathyroid adenoma is essentially equivalent to resection in terms of the IOPTH kinetics and can be used to guide the procedure. Additionally, intrathyroidal parathyroid adenomas are the ideal candidate when considering treating primary hyperparathyroidism with RFA due to the thermal barrier of the thyroid parenchyma. While the cited studies of using RFA for parathyroid adenomas in the typical location describe using hydrodissection to protect the recurrent laryngeal nerve, many noted at least transient dysphonia (8,12,13). This is an important point to discuss with the patient since the risk of dysphonia with RFA of a parathyroid lesion is significantly higher than the risk of dysphonia with surgery. This is potentially because of the difficulty of seeing exactly where the recurrent laryngeal nerve is on ultrasound. Finally, the authors discuss several limitations that must be accounted for when considering RFA for primary hyperparathyroidism. One is that the lesion must be visible on ultrasound in order to guide the procedure. Additionally, while IOPTH can be used to determine whether the ablation was adequate, if the IOPTH does not appropriately drop, the option to convert to a bilateral neck exploration to give the patient the best chance of cure is not feasible. An additional limitation to note is considering re operative surgery. While the case presented was a re operative surgery, there was not a concern for scarring around the parathyroid gland given its intrathyroidal location. However, in other case series that describe RFA for primary hyperparathyroidism, patients with prior neck surgery are excluded (9).

In summary, Kandil *et al.* present a case report of using RFA for an intrathyroidal parathyroid adenoma and demonstrate that IOPTH monitoring can be used to guide the procedure. Given the protection of surrounding thyroid parenchyma in the setting of an intrathyroidal parathyroid adenoma, RFA should be considered a safe alternative therapy to surgical resection for primary hyperparathyroidism. However, RFA to treat primary hyperparathyroidism for glands in the typical location is associated with significant risk to the RLN from thermal spread. Additional risks include the inability to convert to a bilateral neck exploration if IOPTH does not fall and the possibility of increased RLN injury if the patient subsequently chooses to undergo surgery. These factors, as well as the lack of long-term data, must be considered when discussing management options with patients.

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Footnote

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