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RS80A

Ultrasound Technology for Thyroid Radiofrequency Ablation

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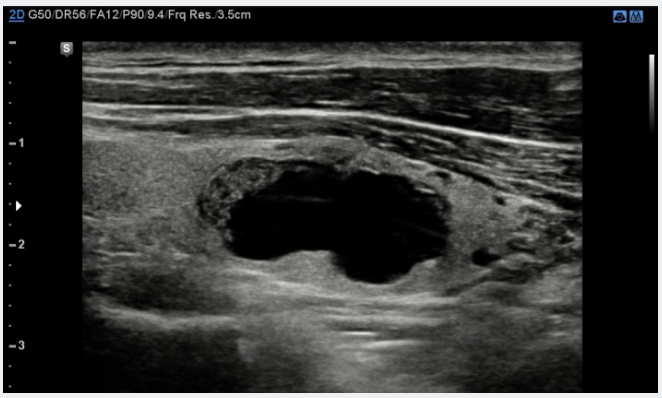
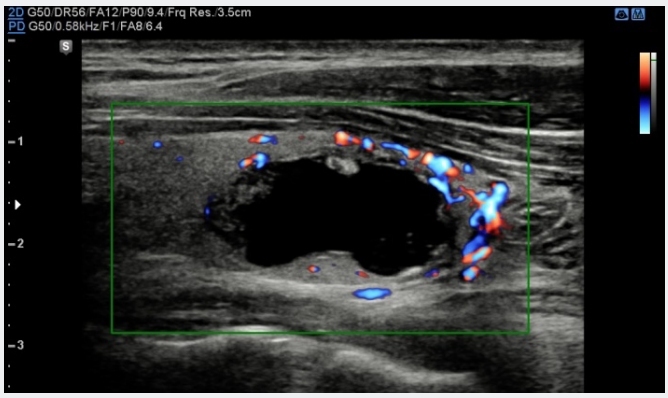




" For radiofrequency ablation of thyroid nodules, ultrasound examination is essential for evaluating targeted thyroid nodule and surrounding critical structures. For example, detection of vagus nerve is important to minimize complication before treatment.

The Color Doppler ultrasound is a primary imaging modality during follow-up. And it is useful for detecting any undertreated or re-growing portion of the ablated nodules. "

Introduction

Thyroid nodules are common clinical problem but majority of thyroid nodules are benign.
Some patients with thyroid nodules require treatment because of cosmetic reasons and/or subjective symptoms. Surgery has been used as a primary treatment tool for these patients. Recently ultrasound (US)-guided radiofrequency ablation (RFA) has been introduced as a complementary tool to treat symptomatic patients.

For thyroid RFA, specialized treatment technique, i.e. the moving shot technique, has been used to improve efficacy and to minimize complications. The standard follow-up tool for RFA is US, therefore the importance of its image quality and functions have been emphasized. In this paper, we will review the basic technology of thyroid RFA and the importance of US and related functions by utilizing Samsung ultrasound system, RS80A.

Technical aspect of US-guided thyroid RFA

Regarding the technique of thyroid RFA, there are two important techniques have been used, a “trans-isthmic approach method” and a “moving shot technique”. Baek et al. have proposed the moving shot technique for thyroid nodules in 2008, in lieu of the fixed electrode technique, which has been used to treat liver tumors. The fixed electrode technique results in a round ablation zone. However, as thyroid nodules are ellipsoidal in shape, round ablation zone is dangerous to surrounding critical structures.

Therefore, the moving shot technique has been suggested as a standard technique for thyroid RFA.

Follow-up after RFA

Regarding the follow-up examination, ultrasound have been suggested as a standard examination. Huh et al. described that a single-session RF ablation is effective in most patients; however, for large nodules (greater than 20 mL) symptoms may persist and additional RF ablation may be required.

Additional treatment can be considered if a viable portion of the nodule (i.e., US showing the same echogenicity as the index nodule and the presence of intra-nodular vascularity on Doppler US), and/or if a patient complains of incompletely resolved cosmetic or symptomatic problems.

Therefore, previous studies suggested importance of Color Doppler US for follow-up and decision of additional treatment.

Clinical values of qualified US for thyroid RFA

1) Before RFA

Evaluation of targeted thyroid nodule and surrounding critical structures are essential.

For example, esophagus or nerves around the thyroid gland should be verified before treatment to reduce thermal injuries. An images captured with Samsung ultrasound system, RS80A, reflects a clear view of the anatomy (Figure 1). The medial variation of vagus nerve is usually adjacent to thyroid nodule, therefore it can be damaged by RFA. The vagus nerve injury causes serious symptoms such as voice change, palpitation, indigestion and hiccup.

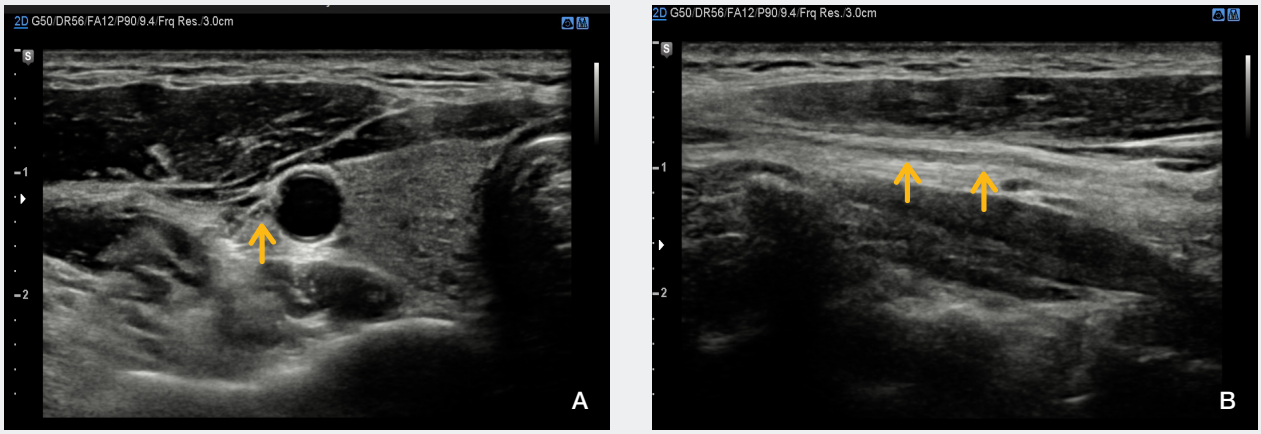


Figure 1. Role of US before treatment. Detection of vagus nerve on transverse (A) and longitudinal (B) images (arrows) is important to minimize complication before treatment.

2) During RFA

Continuous monitoring of RF electrode tip and critical surrounding anatomic structures is essential role of US during RFA. The electrode tip can be exactly monitored by expert; however for the beginners, continuous electrode tip monitoring is challenging. Therefore, advanced technology such as virtual tracking system makes beginners easy to monitor the electrode tip. This technology provides effective guidance in thyroid RFA. It may improve the accuracy and the outcome of RFA while reducing the complication rate and shortening the learning curve for this procedure (Figure 2).

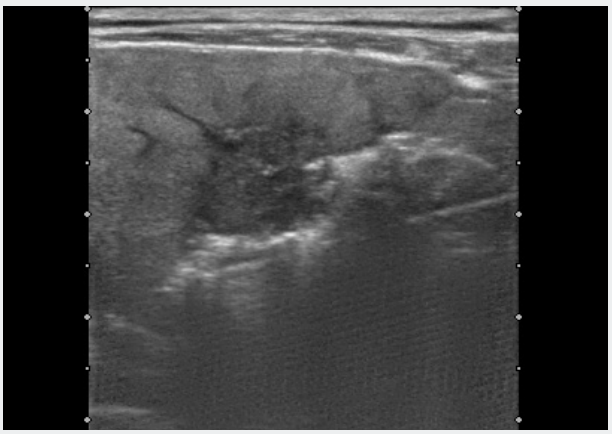
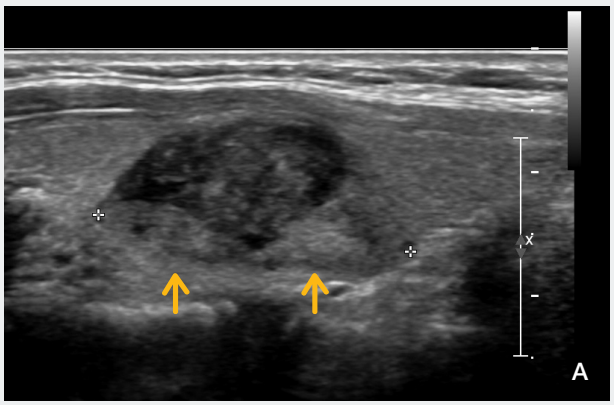


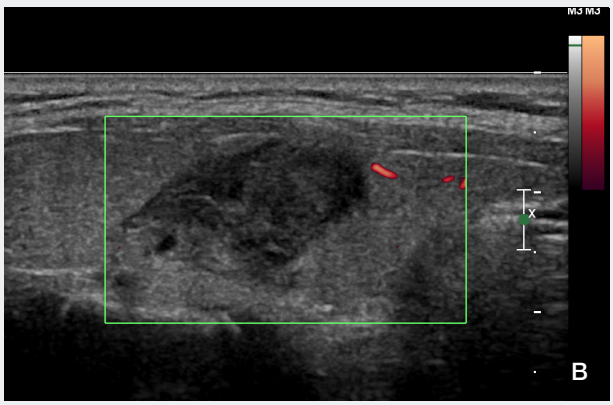
Figure 2. Monitoring of electrode tip during the ablation.
The electrode tip is difficult to monitor during the ablation because of transient hyperechoic zone. Virtual tracking system is helpful for thyroid RFA to monitor the electrode tip.

3) Follow-up and Decision of additional treatment

Color Doppler US is a primary imaging modality during follow-up. Color Doppler US is useful for detecting any undertreated or re-growing portion of the treated nodules. The Korean Society of Thyroid Radiology recommends that patients be followed-up at 1-2, 6 and 12 months after RFA, as well as every 6-12 months thereafter, depending on the status of the treated nodules.

Additional treatments may be indicated in patients with incompletely resolved clinical concerns or if a viable growing portion of the nodule is detected on Color Doppler US (Figure 3).





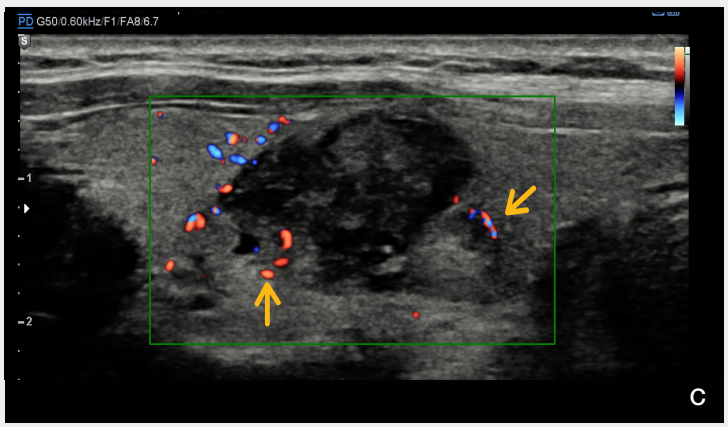


Figure 3. Value of Color Doppler US to detect undertreated area of thyroid nodule

A) Gray-scale US shows undertreated isoechoic area (arrows)

B) Color Doppler US of another company unable to show color signal in undertreated area

C) Samsung Ultrasound system (RS80A) shows definite color signal (arrows). Additional treatment was done for the undertreated area.

Conclusion

The quality of US system and new technology for thyroid RFA are important to increase efficacy and minimize complications.

In the future, high quality Color Doppler system as demonstrated with RS80A, and advanced virtual tracking system could increase the accuracy and the outcome of RFA while reducing the complication rate and shortening the learning curve.

Supported System

(1) RS80A

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