EM-S01

From the Beginning: Diagnosis of Thyroid and Parathyroid Diseases

Hung-Yu Chang
Division of Endocrinology and Metabolism
Department of Internal Medicine, Chang Gung Memorial Hospital

High-resolution ultrasonography is the most sensitive imaging modality available for examination of the thyroid gland and associated abnormalities. Although
there is some overlap between ultrasound (US) appearance of benign and malignant thyroid nodules, certain US features are helpful in differentiating the two. The presence of even one suspicious US feature (irregular margins, taller than wide shape, marked hypoechogenicity or microcalcifications) increases the cancer risk.

Doppler signals, which are superimposed on real time gray scale images, can be color coded to reveal the velocity and direction of blood flow as well as the degree of vascularity of an organ. It has been proposed that solid hypervascular thyroid nodules have a high likelihood of malignancy. In a study where 98% of the cancers were PTC, intranodular vascularity did not have independent predictive value for malignancy in multivariate logistic regression model including gray-scale features . Other studies with higher proportions of follicular thyroid cancer (10%–22%) have shown that intranodular vascularity was correlated with malignancy. Hypervascularity in thyroid parenchyma is seen in patients with autoimmune thyroid diseases, especially in those with hyperthyroidism. On gray-scale US, thyroid is diffusely enlarged , hypoechoic and heterogeneous. Color flow imaging reveals a spectacular “thyroid inferno" with marked hyper vascularity. The characteristic US appearance of Hashimoto’s thyroiditis is focal or diffuse glandular enlargement with coarse, heterogeneous and hypoechoic parenchymal echo pattern.

Thyroid gland elastography is used to study hardness/elasticity of the thyroid nodule to differentiate malignant from benign lesions. A benign nodule is softer and deforms more easily, whereas the malignant nodule is harder and deforms less when compressed by ultrasound probe. US elastography helps in characterizing a cytologically indeterminate nodule as malignant or benign with high accuracy.

The normal parathyroid gland is difficult to reliably identify on US. US represents an abnormal parathyroid gland as an oval, bean-shaped, or infrequently, multilobulated hypoechoic mass with a well-defined margin, located posteriorly or inferiorly to the thyroid gland. Parathyroid adenoma is typically hypervascular on color doppler around the capsule and centrally. Internal heterogeneity can result from fat, hemorrhage, or calcification. The identification of a polar feeding artery can distinguish parathyroid glands from lymph nodes, which usually have a hilar blood supply.

EM-S02

Artificial Intelligence in Thyroid Ultrasound

Shyang-Rong Shih
Department of Internal Medicine, National Taiwan University School of Medicine, National Taiwan University School of Medicine

Ultrasound has been used as the first-line imaging modality in identifying thyroid diseases by many guidelines, such as the American Thyroid Association. The diagnostic performance of ultrasound is inevitably reduced due to the intrinsic property of high operator-dependence. Artificial intelligence (AI) excels at automatically recognizing complex patterns and providing quantitative assessment for the images. It shows high potential to assist physicians in acquiring more accurate and reproducible results. With the advent of well-performed AI-related technologies, deep learning involved with thyroid ultrasound imaging has been increasingly focused on detecting and diagnosing thyroid nodules. For example, a study showed that a multi-scale convolutional neural networks-based method for thyroid nodule detection and classification had achieved significantly better

sensitivity, specificity and accuracy than those of radiologists. Other researchers created six machine learning models to classify suspicious thyroid nodules undergoing fine needle aspiration. Among them, the deep neural networks performed better than other five models to help distinguishing Bethesda class III from class IV, V, VI lesions, and therefore help providing effective and efficient management for the nodules. Besides, effective delineation of the nodular boundaries in thyroid ultrasound plays an important part in characterizing thyroid diseases. Some researchers proposed a conventional neural networks-based method to segment thyroid nodules automatically and accurately. In addition, a deep learning-based algorithm to assess the prognosis of thyroid nodules and the need to further evaluate them has been developed. AI in the thyroid ultrasound has also been developed to help detect papillary thyroid cancer and lymph node metastases, and to help diagnose follicular carcinoma. There are still many challenges and opportunities for the clinical practice of biomedical AI systems in ultrasound.

EM-S03
The New Development of Radiofrequency Ablation in Thyroid and Parathyroid Diseases

Yu Hsuan Li
Division of Endocrinology and Metabolism, Taichung Veterans General Hospital

The efficacy of thyroid radiofrequency ablation (RFA) is well-established in benign thyroid goiters. Many reports have established the short-term efficacy (6-12 months) and safety of RFA for reducing the volume of benign nonfunctioning nodules (50-85%). Long- term data are starting to emerge with recommendations for the number of treatments required to maintain volume reduction of benign nodules.

However, thyroid RFA for thyroid cancer is still controversial. Different from thyroid RFA for benign goiters, thyroid RFA for mPTC are treated with curative intention. Ablative margins beyond the nodule are necessary, a factor that is considered during patient selection and procedure planning.

The major contraindications include presence of extrathyroidal extension, presence of cervical adenopathy, genetic basis for thyroid malignancy (eg, Cowden syndrome, familial adenomatous polyposis, Carney complex), and limited visualization by ultrasound. Whether a subcapsular location of the tumor is a contraindication to ablation is debatable and depends on the experience of the operator with hydrodissection techniques. Additional concerns are raised by limited neck mobility, prior surgical scars over the area or prior radiation therapy.

RFA also is emerging as a treatment option for primary hyperparathyroidism, especially for those with high surgical risks. The role of RFA in secondary hyperparathyroidism is still under debate, since the literature showed conflict result in patient with secondary hyperparathyroidism. The heterogenicity of patients selection is one of the main factors.

EM-S04
The Pitfalls of Clinical Practice in Thyroid Radiofrequency Ablation

Wu-Lung Chuang MD.
Chuanghua Christian Hospital

Radiofrequency ablation (RFA) is well applied to treat thyroid nodules and parathyroid lesions. Besides benign thyroid lesion, RFA is also used to treat recurrence of malignant tumor and lymph node metastasis. In order to avoid complications of RFA, it's very important to know neck anatomy, locations of vessels and nerve distribution.