Thyroid Cancer

Ultrasound Imaging and Fine-Needle Aspiration Biopsy

Michelle Melany, MD[a],*, Sardius Chen, MD[b]

KEYWORDS

- Thyroid ultrasound • Nodule • Papillary cancer • FNA

KEY POINTS

- Ultrasound is critical in diagnosis and management of thyroid nodules. Nodules detected by imaging or palpation should undergo further characterization with diagnostic ultrasound to determine whether sonographic features suggest malignancy and the need for fine-needle aspiration.
- Preoperative and postoperative diagnostic ultrasound evaluation of cervical lymph nodes and ultrasound-guided intervention are also critical to management of thyroid cancer.
- Future developments in thyroid ultrasound, including elastography and refinements in thyroid ultrasound reporting lexicon, may impact future management and may obviate the need for follow-up in certain low-risk or frankly benign lesions.
- Advances in molecular testing may result in a test with strong predictive capability that could potentially prevent unnecessary thyroid surgery in significant numbers of patients.

INTRODUCTION

Ultrasound is a widely available, highly sensitive imaging modality for detection and characterization of thyroid nodules. Updated consensus guidelines from the American Thyroid Association (ATA) and other medical societies continue to highlight advantages of ultrasound and maintain that thyroid ultrasound with attention to cervical lymph nodes should be performed in all patients with suspected or known thyroid nodules.[1]

When thyroid cancer is diagnosed, if not previously performed, focused ultrasound evaluation of lateral compartment cervical lymph nodes is performed before surgery.

endo.theclinics.com

"Lymph node mapping" refers to a detailed ultrasound examination by an experienced sonographer or sonologist as preoperative evaluation for potential nodal metastatic disease. Although often described as operator dependent, ultrasound in experienced hands is more accurate than other imaging modalities, including magnetic resonance (MR), computed tomography (CT), PET/CT, and whole body iodine scan (WBS) in detecting cervical metastases from thyroid cancer.[2] All patients undergoing thyroidectomy for malignancy should undergo preoperative neck ultrasound to evaluate central, right, and left lateral compartment nodes.[1] Should abnormal lateral compartment nodes be detected preoperatively, the patient may undergo FNA of suspicious nodes and, if appropriate, will be offered thyroidectomy with neck dissection to surgically remove involved or suspicious nodal groups. Ultrasound of the thyroid bed (central compartment) and lateral compartments is used in routine thyroid cancer follow-up after treatment. Ultrasound is more sensitive than WBS and serum thyroglobulin (Tg) in detecting local recurrence, residual disease, and lateral compartment metastases, and is the initial test in follow-up of patients with thyroid cancer.[3]

Diagnosis of malignant thyroid nodules, nodal metastases, and central compartment recurrence with fine-needle aspiration biopsy (FNAB) is often performed with ultrasound guidance. Other ultrasound-guided interventional procedures include preoperative localization with charcoal/dye, percutaneous ethanol, and radiofrequency ablation of metastatic lesions in the central and lateral compartments.[4,5]

Neck CT and MRI are not used in the *initial* evaluation of thyroid nodules. Routine use of neck CT, MR, PET and PET/CT imaging is not supported in patients with differentiated thyroid malignancy. However, in patients with invasive thyroid cancer who have extension outside the gland, these modalities may be preferable to investigate involvement of adjacent structures, including the carotid artery, jugular vein, larynx, and trachea. Regional or distant metastases may be detected with the previously described imaging modalities.[1,6]

THYROID NODULES

Thyroid nodules are discrete lesions within the gland that are radiographically distinct from adjacent thyroid parenchyma. Increased use of neck and chest PET/CT, CT, MRI, and neck ultrasound for imaging has dramatically increased diagnostic ultrasound and ultrasound-guided fine-needle aspiration (FNA) of nonpalpable thyroid nodules. Major clinical societies involved in thyroid cancer diagnosis disagree about guidelines for FNA of these "incidentalomas."[7] Maximizing detection of clinically relevant thyroid cancer while decreasing FNA of benign nodules is critical to managing health care dollars spent on thyroid evaluation. This article includes discussion of ultrasound features of thyroid cancer, including pattern recognition of benign nodules and features that suggest papillary thyroid cancer (PTC).

ULTRASOUND FEATURES OF THYROID CANCER

Ultrasound features that suggest thyroid nodule malignancy include solid composition, hypoechoic/markedly hypoechoic, intranodular blood flow, calcification, lack of a well-defined halo, ill-defined or spiculated margins, and "taller-than-wide" configuration. Review of the literature reveals these features to have highly variable sensitivities, specificities, and positive and negative predictive values (PPV and NPV). No single ultrasound feature is adequately sensitive or specific to confirm or rule out malignancy.

Multiple studies report ultrasound features *in combination* may better stratify malignancy risk. For example, nodules with no suspicious features carry less than 2% risk,