Use of Office Ultrasound in the Thyroid Surgery Practice

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**Thyroid US**

- Diagnosis of thyroid nodules
- Measure and characterize nodules (cystic vs. solid, size, echogenicity, vascularity, calcifications, …)
- Objective monitoring over time
- Characterize thyroid disease (thyroiditis, Graves)
- Guide biopsy (and procedures)
- Assess extrathyroidal neck
- Follow up of thyroid cancer
- Dynamic assessment of function

**Office-based Head and Neck US**

- Real-time study: image interpretation, static vs. moving/pulsating structures
- Knowledge of patient history and physical exam
- Familiarity with anatomy
- Correlate studies (*I scan, CT, MRI, etc.)
- Single appointment for patient
- USGFNA possible during same appt
- Simultaneous patient education
- Facilitate surgical planning
- Ability to use intraoperative US

**Normal Thyroid/Neck US Anatomy**

- Thyroid
- Trachea
- Esophagus
### Ultrasound Characteristics

#### Benign v. Malignant Thyroid Nodules

<table>
<thead>
<tr>
<th>Benign</th>
<th>Malignant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoechoic/hyperechoic</td>
<td>Hypoechoic</td>
</tr>
<tr>
<td>Coarse calcifications</td>
<td>Microcalcifications</td>
</tr>
<tr>
<td>Thin, well-defined halo</td>
<td>Thick or absent halo</td>
</tr>
<tr>
<td>Regular margin</td>
<td>Irregular margin</td>
</tr>
<tr>
<td>Hypovascular</td>
<td>Increased vascularity</td>
</tr>
<tr>
<td>No lymphadenopathy</td>
<td>Lymphadenopathy</td>
</tr>
</tbody>
</table>

#### Nodules < 1 cm that justify FNA

- Hypoechoic AND one or more of the following:
  - increased vascularity
  - irregular borders
  - microcalcifications
  - history of XRT

### Thyroid Ultrasound

#### Examples

![Normal Thyroid Image](image_url)
Graves Disease

Chronic Thyroiditis

Toxic Nodular Goiter

Benign Thyroid Nodules

Comet tail echoes
Cystic degeneration
Colloid Nodules
Colloid Nodules

Benign Thyroid Nodule (BTN)

Comet tail echoes

Coarse calcification

Microcalcifications

Papillary Thyroid Carcinoma

Incidental finding in patient with Warthin tumor

Incidental finding in patient with Warthin tumor
Microcalcifications AND hypervascularity

Cystic Papillary Carcinoma

Nonpalpable PTC primary tumor

PTC: Aggressive Features
Peripheral vs. Internal blood flow

Benign

Malignant (Hurthle cell)

Solid lesion with well-defined halo

FVPTC

Follicular Adenoma (with hemorrhage)

Follicular adenoma (retrospective dx)

Which follicular lesion is benign?

A

B

C
Medullary Thyroid Cancer

Anaplastic Thyroid Cancer

Recurrent Medullary Thyroid Cancer

Left trans thyroid
Left trans level II

No history of surgery…
Lingual Thyroid

Irradiated Thyroid
s/p ^131^Iodine ablation

Thyroglossal Duct Cyst

Ultrasound Characteristics
Benign v. Malignant Lymph Nodes

**Benign**
- Oval
- Small
- Hilum visible
- Isoechoic/hyperechoic
- No calcifications
- Regular margin
- Hilar vascular pattern
- Single
- Distinct from surrounds

**Malignant**
- Round
- Large
- Hilum not visible
- Hypoechoic/heterogeneous
- Microcalcifications
- Irregular margin
- Disordered vascular pattern
- Multiple
- Invasion of surrounds
Benign level III lymph node

- Oval (L:W ratio > 2:1)
- Visible hilum
- Solitary
- Well-defined

Metastatic Papillary CA

L Level 3

Metastatic PTC

R Level 4
Metastatic PTC

R Level 3 and L Level 4

Recurrent PTC in thyroid bed

Irregular, Extranodal spread

Thyroid Cancer Lymph Node Metastases

Persistent PTC in lateral neck (movie)

Microcalcifications
US of Larynx, same patient (movie)

Impact of US

- US detected nodal or soft tissue metastases in neck compartments believed to be uninvolved by physical exam in 39% of patients, (thereby altering the surgical procedure and apparently minimizing local-regional recurrence)


USGFNA

- Seiberling KA et al: Office-based USGFNA with on-site cytology review:
  - 81% satisfactory/10% unsatisfactory/9% “limited”
  - Comparable to the Radiology literature (Laryngoscope 2008;118(2):228.)

- Bhatki AM et al: Office-based USGFNA without on-site cytology review:
  - 93% adequacy of specimens/7% nondiagnostic or suboptimal
  - Experience, capillary & aspiration techniques, 3-4 passes (OHNS 2008;139(1):27.)

Value of Preoperative Ultrasonography in the Surgical Management of Initial and Reoperative Papillary Thyroid Cancer

- Preop US detected nonpalpable LN mets in 33% of pts with PTC, thereby altering the procedure performed

- Even in pts with palpable LN’s, US helped to guide the extent of lymphadenectomy

Arch Surg. 2006;141:489-496
**Sensitivity of US**

- US: Sn for central = 52%, lateral = 77%  
  (Kouvaraki MA et al, Surgery, 2003; 134(6):946-54.)
- Preop imaging f/b MRND: Sn of US = 39%  

**Comparison of Imaging Modalities at all levels (I – VI)**

<table>
<thead>
<tr>
<th>Modality</th>
<th>Sn</th>
<th>Sp</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET/CT</td>
<td>30%</td>
<td>96%</td>
<td>87%</td>
</tr>
<tr>
<td>US</td>
<td>41%</td>
<td>97%</td>
<td>89%</td>
</tr>
<tr>
<td>CECT</td>
<td>35%</td>
<td>96%</td>
<td>87%</td>
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Jeong HS et al. Integrated 18F-FDG PET/CT for the initial evaluation of cervical node level of patients with papillary thyroid carcinoma: comparison with ultrasound and contrast-enhanced CT. Clin Endocrinol (Oxf). 2006 Sep;65(3):402-7.

**Sensitivity of CT**

- CT with contrast: Sn = 60% for central and lateral neck, missed on PE.
- PPV = 84% central/73% lateral (NPV 47%/57%)

Conclusion: CT (like other imaging studies) has a limited ability to detect subclinical mets due to microscopic foci, but a (+) CT predicts with high likelihood that disease will be found in a given compartment during ND

**Advantages of Office Ultrasound**

- Augments physical examination
- Low cost, painless, dynamic, reproducible and repeatable
- No radiation; no preparation/ LT4 withdrawal/ low-iodine diet/ rhTSH injections; no iodine load; no dependence on iodine uptake
- Comprehensive node examination
- Objective comparison of follow-up dimensions
- Accurate needle placement with FNA/sampling
- Best assessment of thyroid and parathyroids together
- US analysis in real time
- Patient convenience and education
- Preoperative planning and Intraoperative procedures

Parathyroid US

- Preoperative localization
- 3D view and relation to other structures
- Assess for other pathology (e.g. thyroid)
- Localize ectopic parathyroid
- Guide biopsy/sample for PTH

Parathyroid Ultrasound

- Sn 65-93% for adenomas; 30-90% for enlarged glands
- 3-dimensional anatomic information
- Identify concomitant thyroid disease
- No radiation
- No preparation
- Can be used intraoperatively
- COMPLEMENTARY to Sestamibi scans

Office-based Parathyroid US

- Accuracy for side and quadrant greater than sestamibi:
  - 90% (Steward DL et al, Laryngoscope 2006;116(8):1380-4.)
  - 90% for side, 83% for quadrant vs. 71%/61% for sestamibi (Gurney TA and Orloff LA, Laryngoscope 2008;110(2):243-6.)

Thank you