The Sonographic Evaluation of Diffuse Thyroid Disease and Thyroiditis

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Diffuse Thyroid Disease

• **Graves’ Disease**
  – (toxic diffuse goiter)

• **Thyroiditis**
  – Chronic lymphocytic thyroiditis (Hashimoto’s)
  – Non-specific/atrophic
  – Subacute
  – Acute inflammatory
  – Drug related/Destructive thyroiditis
Sonographic Findings of Diffuse Thyroid Disease

• Gland enlargement
  – Normal volume
    19.6 +/- 4.7 ml for men, 17.5 +/- 4.2 ml for women, scaling with BMI
  – Isthmus over 5 mm
  – Variants: normal size and small gland

• Altered parenchymal echotexture and/or echogenicity

• Increased vascularity
  – Most marked in Graves’

• Lymphadenopathy
  – usually minimal and in the central compartment
Diffuse Thyroid Disease

- Enlarged gland
- Decreased echogenicity
- Heterogeneous echotexture
Enlarged Thyroid with Normal Echogenicity and Echotexture

- Normal variation-Height, BMI, Gender, Race, Age
- Mild iodine deficiency
- Medical conditions: pregnancy, renal disease
- Subclinical autoimmune thyroid disease
- Check serum TSH
Thyroid Volume and Subclinical Disease

- Retrospective analysis of 1,089 adolescents in Slovakia, mean age 17 years
- Correlated thyroid volume with TSH and TPO Abs in 50% of the population studied
- Assessed whether enlarged thyroid volume had a relationship with subclinical or early thyroid dysfunction

<table>
<thead>
<tr>
<th>Gland Volume</th>
<th>Proportion of Cohort</th>
<th>% TPO Positive</th>
<th>TSH &gt; 4.5 mU/L</th>
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<tbody>
<tr>
<td>&lt; 5 mL/m²</td>
<td>81%</td>
<td></td>
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<tr>
<td>5-7 mL/m²</td>
<td>13%</td>
<td>5%</td>
<td>1%</td>
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<tr>
<td>&gt; 7 mL/m²</td>
<td>6%</td>
<td>21%</td>
<td>10%</td>
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Graves’ Disease

- Marked increase in gland size; less commonly normal or minimally enlarged
- Echotexture may be normal or diffusely hypoechoic
- Smooth or lobular surface contour
Graves’ Disease

- Diffuse increased vascularity: “thyroid inferno”
- Prominent extra-thyroidal vessels
- Peak systolic velocity of 40 cm/sec or higher has 96% sensitivity and 95% specificity for GD

Role of Sonography in Graves’ Disease

• CDUS may be used to confirm diagnosis in lieu of I-123 scan
  – sensitivity of CDUS (95% vs. 97%) and specificity (95% vs. 99%) for Dx of GD

• Screening for occult cancer
  – Sonography identified 68/426 (16%) focal nodules vs. 9/462 (2.1%) on I-123 scan
  – Thyroid cancer found in 30/68 (48%) of these patients

• All patients with GD should be screened by US-management changed to surgical

Cappelli C et al, Eur J Rad 2008; 65;99-103
Graves’ with Occult PTC
Graves’ with Occult PTC
Graves’ with patchy regions: Lymphocytic infiltrate on FNA
Chronic Lymphocytic (Hashimoto’s) Thyroiditis

- Most common type of thyroiditis
  - 5 to 10% of the adult population is affected
- Autoimmune disease occurring most frequently in middle aged women, with strong familial predisposition
- Patients may be eu-, hypo- or hyperthyroid
- 95% of patients have circulating anti-thyroglobulin antibodies
Chronic Lymphocytic (Hashimoto’s) Thyroiditis

Cobblestone Street in Philadelphia
Sonographic Appearance of Chronic Lymphocytic Thyroiditis

- **Gland size**
  - enlarged, normal or small

- **Parenchymal hypoechogenicity**
  - Diffuse or patchy regions
  - May precede antibody positivity (15% pts)
  - **Fibrosis common**

- **Vascularity**
  - Variable, correlates with immune response

- **Lymphadenopathy**
  - Common in the central compartment
Hashimoto’s Thyroiditis

Normal

Hashimoto’s

3 mm

7 mm
Multiple hypoechoic, ill-defined “nodules” 1-6mm in size

Geographic hypoechoic areas

Linear white lines representing fibrosis

Interrupted capsule

Variable vascularity
Micronodular pattern \textit{does not equal} “multinodular goiter”
Hashimoto’s Thyroiditis

- Normal follicles
- Lymphocytic infiltration
- Fibrosis

Normal follicles
Are these nodules??
Cleft sign
“Patchy” thyroiditis vs. nodules
Hashimoto’s Thyroiditis

- Over time the gland tends to become more hypoechoic and enlarged
- Palpable surface nodularity
- “Pseudonodular” sonographic appearance
- End-stage may be a small and irregular gland
Association of Papillary Cancer with Hashimoto Thyroiditis

• Reported higher prevalence of PTC with HT- varies from 0.3% to 22.5%
  
  Dailey ME et al, Arch Surg, 1995; 70:291
  Matsubayashi S et al, JCEM 1995; 80; 3421

• Expression of the RET/PTC fusion gene is a marker of PTC in HT
  
  Wirtschafter A et al, Laryngoscope 1997; 107:95

• PTC patients with PTC two times more likely to have HT
  
  Feldt-Rasmussen U, Hormones 2010
PTC in Hashimoto’s

Papillary carcinoma

Longitudinal view

Transverse view
Appearance of PTC in HT glands

• Typical PTC features overlap with HT features
  – Hypoechochogenicity, solid consistency, irregular or infiltrating margins
• Key finding is pattern of calcifications
  – Clustered microcalcifications or dystrophic calcifications
  – Asymmetrical lobar involvement

Ohmori N et al, Internal Medicine (Japanese Society of Internal Medicine) 2007; 46; 547.
Infiltrating PTC in CLT

Microcalcifications throughout the right lobe without a focal mass
21 yo female with enlarged thyroid on physical exam
Diagnosis?
Scattered Calcifications

Psammoma Bodies

Lateral Cervical Nodes
Diffuse Sclerosing Variant of Papillary Thyroid Cancer

- Accounts for 0.8% to 5.3% of PTC
- Patients present with a diffuse goiter
- Mostly are euthyroid (hypothyroid or hyperthyroid)
- Most frequently in young females
- Mistaken for thyroiditis
- Lymph node and lung metastases are common
- Similar cure rates c/w classic PTC
Hashimoto’s thyroiditis is often asymmetric
Can be a solitary focal lesion
Accounts for up to 10% of focal lesions
May still require FNA
Dilemma: Nodules in patients with Diffuse Thyroid Disease

- May have patchy irregular areas that are pseudo-nodules
  - Tend to be small (under 15 mm), hyperechoic and non-calcified
  - Larger lesions or those with irregular margins raise concern for a neoplasm

- Focal calcifications and asymmetric calcifications should be considered suspect for papillary carcinoma
Hyperechoic Lesions

PTC
Malignant Lymphoma

- Usually occurs in a CLT gland
- 2 to 5% of all thyroid malignancies
- Nodular pattern
  - Homogeneously hypoechoic with lobulated but well defined border; enhanced though transmission
- Diffuse disease-asymmetric enlargement
- Mixed pattern

Ito Y et al, World J Surg 2010; 34:1171-80,
Thyroid Lymphoma

Small and atrophic right lobe

Enlarged and hypoechoic left lobe
Thyroid Lymphoma

Enlarged left lobe
Hypoechoic, lobulated lesion
Good through transmission
Hashimoto’s with Unilateral Lateral Cervical Lymphadenopathy
Subacute Thyroiditis—“DeQuervains”

- 0.16 to 0.36% of thyroid disease
- Usually a viral infection
- Usually an adult female with thyroid tenderness, systemic systems
- May have thyrotoxicosis or be euthyroid
- Hypoechoic patchy or nodular areas that resolve
- Variable vascularity
  - Maybe highly vascular and simulate Graves Disease
43 yo female patient with a swollen and painful thyroid

Subacute Thyroiditis
One year later
Atrophic Thyroiditis

- Autoimmune thyroid disease
- Small and atrophic gland
- Maybe hypoechoic or normal echogenicity
- Normal or low uptake on I-123 scan
Amiodarone-Induced Thyrotoxicosis (AIT)

- More commonly patients develop hypothyroidism due to iodine content
- The minority develop thyrotoxicosis
- Type 1 is an iodine load-induced hyperthyroidism which occurs in abnormal glands (MNG or Graves); increased vascularity
- Type 2 is a destructive thyroiditis; normal gland; normal or decreased vascularity; low/absent uptake on RAIU
74 yo man on Amiodarone for several years now with hyperthyroidism

Type II AIT; low flow on CDUS
Interferon related Thyroiditis: Serum TSH 12mU/L
Conclusions

- Sonographic markers of autoimmune thyroid disease include enlarged size, heterogeneous echotexture, increased vascularity, but are not specific.
- Clinical information is key.
- Differentiation of “pseudo-nodules” from true nodules and tumors may be challenging.
  - Asymmetric calcifications
  - Unilateral large LNS
Thank you for your attention!

Nodular Disease

Diffuse Disease