Evaluation of a Thyroid Nodule

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The Big Question

Is it cancer?
A Brief History of the Thyroid

• 1812 – Gay-Lussac discovers iodine in seaweed-water (was corroding the copper vats of Napoleon’s gunpowder industry)
• 1816 – Prout successfully treats goiter with Iodine
• 1835-40 – Graves and von Basedow describe “Merseburg triad” of goiter, exophthalmos, and palpitations
A Brief History of the Thyroid

• 1836 – Cruveilhier establishes as ductless gland (bronchocele theory discarded)
• mid 1800’s – Iodine abused as “miracle drug” – falls into disrepute
• 1870’s – Fagge links thyroid hypofunction to cretinism
• 1886 – Horsley postulates thyroid hypersecretion as cause of Graves’ Disease
A Brief History of the Thyroid

- 1891 – Murray cures myxedema with hypodermic extract of sheep thyroid
- 1893 – Muller links thyroid to metabolic activity
- 1910 – Marine – shown that “cancer” in brook trout really goiter due to iodine deficiency
- Marine – “Akron experiment” – dietary enrichment of iodine decreases goiter in schoolchildren
A Brief History of the Thyroid

- 1915 – Kendall crystallizes thyroxine
- 1923 – Goler – adds iodide to Rochester water supply (furor over “invasion of privacy”)
- 1929 – TSH identified
- 1934 – Fermi – produces radioactive Iodine
- 1950 – Duffy – associates XRT with thyroid cancer
- 1970’s – FNA comes into use
History of Thyroid Surgery

- Condemned for years as heroic and butchery
- 1850 – French Academy of Medicine proscribed any thyroid surgery
- mid 1800’s – only 106 documented thyroidectomies
  - Mortality 40%: exsanguination and sepsis
History of Thyroid Surgery

- 1842 – Crawford Long uses ether anesthesia
- 1846 – Morton demonstrates at MGH
- 1867 – Lister describes antisepsis (Lancet)
- 1874 – Pean – invents hemostat
- 1883 – Neuber – Cap & gown (asepsis)
History of Thyroid Surgery

1870’s-80’s – Billroth – emerges as leader in thyroid surgery (Vienna)

- Mortality 8%
- Shows need for RLN preservation
- Defines need for parathyroid preservation (von Eiselberg)
- Emphasis on speed
History of Thyroid Surgery

- Kocher – emerges as leader in thyroid surgery (Bern)
  - Mortality:
    - 1889 – 2.4%
    - 1900 – 0.18%
  - Emphasis on meticulous technique
  - Performed 5000 cases by death in 1917
  - Awarded 1909 Nobel Prize for efforts
History of Thyroid Surgery

- Halstead
  - Studied under Kocher and Billroth
  - Returned to US 1880
  - Worked at Hopkins with Cushing, Osler, Welch
  - Laid groundwork for thyroid specialists Mayo, Lahey, Crile
Epidemiology
Epidemiology – Nodule

- Nodules common, whereas cancer relatively uncommon
- Goal is to minimize “unnecessary” surgery but not miss any cancer
Epidemiology – Nodule

• Framingham study
  – Ages 35 – 59
    • Women 6.4 %
    • Men 1.5 %
  – Acquisition rate of 0.09 % per year

• Mayo study (autopsy series – no thyroid hx)
  – 21% had 1 or more nodules by direct palpation
    • Of those, 49.5% had histological nodules
    • 35.5% greater than 2 cm
Epidemiology – Nodule

- Palpation versus ultrasound/autopsy
Epidemiology – Nodule

- Increases with age
  - Autopsy – 9th decade – 80% women, 65% men
- Higher in women (1.2:1 $\Rightarrow$ 4.3:1)
- Estimated 5-15% of nodules are cancerous
- Although cancer more common in women, a nodule in a man is more likely to be cancer
Epidemiology – Pregnancy

• Pregnancy increases risk
  – One study: u/s detection nodules –
    • 9.4% nulliparous women
    • 25% women previously pregnant
  – Attributed to increased renal iodide excretion and basal metabolic rate
  – Rosen: Nodules presenting during pregnancy –
    • 30 patients, 43% were cancer
    • HCG may be growth promoter (TSH-like activity)
Recommendations – Pregnancy

• Some author recommendations:
  – Surgery done for cancer before end of 2nd trimester, else post-partum
  – Women with h/o thyroid cancer – avoid pregnancy
Epidemiology – Radiation

• 1 million Americans – XRT to head & neck between 20’s and 50’s for benign disease
• 1946 – Nobel prize awarded to Muller for linking radiation to genetic mutations
• 1950 – Duffy & Fitzgerald link thyroid cancer to childhood XRT exposure
• 1976 – NIH initiates “recall” program to encourage medical screening for previous XRT patients
Epidemiology – Radiation

- Marshall Islanders exposed to nuclear fallout:
  - Nodules in 33%, 63% children < 10 at time
- Japanese: increased nodules in residents of Hiroshima / Nagasaki circa 1945
  - Increased occult thyroid ca in Japanese without direct radiation exposure
- Chernobyl – possible increase in neoplasms
- Therapeutic XRT for malignancy raises risk for thyroid neoplasia
### Table 1. POTENTIAL SOURCES OF RADIATION EXPOSURE

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical treatment for benign and malignant conditions</td>
<td>Medical treatments involving radiation exposure:</td>
</tr>
<tr>
<td>Thymus (enlargement as possible cause of “crib death”)</td>
<td>Possible cause of crib death due to radiation exposure.</td>
</tr>
<tr>
<td>Posterior pharynx and tonsils (tonsillitis)</td>
<td>Tonsillitis may be exacerbated by radiation exposure.</td>
</tr>
<tr>
<td>Cervical lymph node (adenitis)</td>
<td>Lymph node swelling caused by radiation exposure.</td>
</tr>
<tr>
<td>Bronchial airways (bronchitis)</td>
<td>Bronchitis may be exacerbated by radiation exposure.</td>
</tr>
<tr>
<td>Skin (hemangiomas)</td>
<td>Hemangiomas on the skin may be caused by radiation exposure.</td>
</tr>
<tr>
<td>Skin (cystic acne)</td>
<td>Cystic acne on the skin may be caused by radiation exposure.</td>
</tr>
<tr>
<td>Pulmonary (multiple fluoroscopies for tuberculosis)</td>
<td>Multiple fluoroscopies for tuberculosis may cause radiation exposure.</td>
</tr>
<tr>
<td>Scalp (tinea capitis)</td>
<td>Tinea capitis on the scalp may be exacerbated by radiation exposure.</td>
</tr>
<tr>
<td>Eustachian tubes (hearing loss in children)</td>
<td>Eustachian tubes may be affected by radiation exposure.</td>
</tr>
<tr>
<td>Eustachian tubes (inability to serve on aircraft or in submarines)</td>
<td>Inability to serve on aircraft or in submarines due to radiation exposure.</td>
</tr>
<tr>
<td>Head and neck and other malignancies</td>
<td>Head and neck and other malignancies may be caused by radiation exposure.</td>
</tr>
<tr>
<td>Radiation exposure resulting from the acts of others</td>
<td>Radiation exposure caused by others:</td>
</tr>
<tr>
<td>Atomic explosions (Japan, Marshall Islands, Utah area)</td>
<td>Atomic explosions in Japan, Marshall Islands, and Utah area may cause</td>
</tr>
<tr>
<td>Nuclear facility releases (Hanford, WA)</td>
<td>Releasologies at Hanford, WA may cause radiation exposure.</td>
</tr>
<tr>
<td>Nuclear facility accidents (Chernobyl)</td>
<td>Nuclear accidents at Chernobyl may cause radiation exposure.</td>
</tr>
<tr>
<td>Ecological</td>
<td>Ecological factors:</td>
</tr>
<tr>
<td>Occupational</td>
<td>Occupational radiation exposure.</td>
</tr>
<tr>
<td>Terrestrial</td>
<td>Terrestrial radiation exposure.</td>
</tr>
<tr>
<td>Altitudinal</td>
<td>Altitudinal radiation exposure.</td>
</tr>
</tbody>
</table>
Duck and cover

It used to be that school kids were told all they needed to do was crawl under their desks and cover their heads to survive a nuke attack. No more.

Instead of the silly drills, the feds last week ordered 1.6 million doses of potassium iodide to protect against a radioactive fallout.
Epidemiology – Radiation

• Appears to be dose-dependent
  – ERR 7.7 at 100 cGy

• Maximum risk approximately 30 years later

• Nodule in radiated patient: 35-40% cancer

• Data suggest no more aggressive behavior over spontaneously-occurring cancers, but may be larger at presentation

• Only unequivocal environmental cause of thyroid cancer
Childhood Radiation

• Younger age – greater risk
• Suppression may help decrease risk
  – One study: 35.8% → 8.4%
• I-131: risk of leukemia with high doses
Epidemiology – Children

- Nodule more likely to be cancer than adults
  - 1950s: 70%
  - Current: approx 20%
- 10% thyroid cancer age <21
- Thyroid ca 1.5-2.0% all pedi malignancies
- More likely to present with neck mets
- Most common cause thyroid enlargement is chronic lymphocytic thyroiditis
Epidemiology – Children

• Medullary Thyroid Carcinoma
  – FMTC, MEN 2A, MEN 2B
  – RET proto-oncogene (chromosome 10)
  – Calcium / Pentagastrin stimulation
  – Prophylactic thyroidectomy recommended age 2-6
Epidemiology – Other

- Higher rate of nodules found in patients:
  - Who have hyperparathyroidism
  - Are undergoing hemodialysis
Epidemiology – Carcinoma

- Occult carcinoma in 6 – 35 % of glands at autopsy (usu 4-10 mm)
  - Biologic behavior difficult to predict
- 12,000 new thyroid cancers / year
- 1000 deaths / year
- Surgically removed nodules:
  - 42-77 % colloid nodules
  - 15-40 % adenomas
  - 8-17 % carcinomas
Epidemiology – Cancer

• Histological subtype
  – Papillary – 70%
  – Follicular – 15%
  – Medullary – 5-10%
  – Anaplastic – 5%
  – Lymphoma – 5%
  – Mets
Thyroid Mets

- Breast
- Lung
- Renal
- GI
- Melanoma
Papillary Carcinoma

- “Orphan Annie” nuclei
- Psamomma bodies
Follicular Carcinoma

- Capsular invasion must be present
- FNA inadequate for diagnosis
Thyroid Physiology
Evaluation
Differential Diagnosis

Table 2. DIFFERENTIAL DIAGNOSIS OF THE THYROID NODULE

<table>
<thead>
<tr>
<th>Etiology</th>
<th>References</th>
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</thead>
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<tr>
<td>Colloid (adenomatoid) nodule</td>
<td>194</td>
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<tr>
<td>Thyroid adenoma</td>
<td>194</td>
</tr>
<tr>
<td>Follicular adenoma</td>
<td>194</td>
</tr>
<tr>
<td>Hürthle cell</td>
<td>48, 340</td>
</tr>
<tr>
<td>Thyroid cancer</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td></td>
</tr>
<tr>
<td>Papillary</td>
<td>207</td>
</tr>
<tr>
<td>Follicular</td>
<td>194</td>
</tr>
<tr>
<td>Hürthle cell</td>
<td>48, 340</td>
</tr>
<tr>
<td>Medullary</td>
<td></td>
</tr>
<tr>
<td>Anaplastic</td>
<td></td>
</tr>
<tr>
<td>Metastatic/direct invasion</td>
<td></td>
</tr>
<tr>
<td>Renal cell</td>
<td>54, 119, 152, 155, 211</td>
</tr>
<tr>
<td>Breast</td>
<td>155</td>
</tr>
<tr>
<td>Lung</td>
<td>211</td>
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<td>Melanoma</td>
<td>211</td>
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<tr>
<td>Colon cancer</td>
<td>67, 155, 188</td>
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<tr>
<td>Gastric carcinoma</td>
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<tr>
<td>Pancreatic carcinoma</td>
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<tr>
<td>Head and neck tumors</td>
<td>67, 211</td>
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<tr>
<td>Hodgkin's disease</td>
<td>157A</td>
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<tr>
<td>Thyroid lymphoma</td>
<td>64</td>
</tr>
<tr>
<td>Thyroid cyst</td>
<td>306</td>
</tr>
<tr>
<td>Pure cyst</td>
<td></td>
</tr>
<tr>
<td>Complex cyst</td>
<td>68</td>
</tr>
<tr>
<td>Thyroiditis</td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>194</td>
</tr>
<tr>
<td>Subacute</td>
<td>34</td>
</tr>
<tr>
<td>Hashimoto's</td>
<td>306, 320, 322, 349</td>
</tr>
<tr>
<td>Riedel's disease</td>
<td>194</td>
</tr>
<tr>
<td>Graves' disease</td>
<td>56, 326</td>
</tr>
<tr>
<td>Infectious</td>
<td></td>
</tr>
<tr>
<td>Abscess</td>
<td>168, 194</td>
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<tr>
<td>Tuberculosis</td>
<td>166</td>
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<tr>
<td>Infiltrative/granulomatous disease</td>
<td></td>
</tr>
<tr>
<td>Sarcoidosis</td>
<td>330</td>
</tr>
<tr>
<td>Amyloidosis</td>
<td>159</td>
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<tr>
<td>Developmental abnormalities</td>
<td></td>
</tr>
<tr>
<td>Thyroid hemiogenesis</td>
<td>39</td>
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<tr>
<td>Thyroglossal duct cyst</td>
<td>216</td>
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<tr>
<td>Teratoma</td>
<td>206</td>
</tr>
<tr>
<td>Neck structures simulating thyroid nodules</td>
<td></td>
</tr>
<tr>
<td>Aberrant subclavian artery and vein</td>
<td>145</td>
</tr>
<tr>
<td>Lipomas</td>
<td>46, 62, 254</td>
</tr>
<tr>
<td>Extrathyroidal hematoma</td>
<td>307</td>
</tr>
<tr>
<td>Esophageal diverticulum</td>
<td>176</td>
</tr>
<tr>
<td>Parathyroid adenoma, cyst, or carcinoma</td>
<td>254</td>
</tr>
</tbody>
</table>
History

- Age
- Gender
- Exposure to Radiation
- Signs/symptoms of hyper- / hypo- thyroidism
- Rapid change in size
  - With *pain* may indicate hemorrhage into nodule
  - Without pain may be bad sign
History

• Gardner Syndrome (familial adenomatous polyposis)
  – Association found with thyroid ca
  – Mostly in young women (94%) (RR 160)
  – Thyroid ca preceded dx of Garners 30% of time

• Cowden Syndrome
  – Mucocutaneous hamartomas, keratoses, fibrocystic breast changes & GI polyps
  – Found to have association with thyroid ca (8/26 patients in one series)
History

- Familial h/o medullary thyroid carcinoma
  - Familial MTC vs MEN II
- Family hx of other thyroid ca
- H/o Hashimoto’s thyroiditis (lymphoma)
History

• History elements suggestive of malignancy:
  – Progressive enlargement
  – Hoarseness
  – Dysphagia
  – Dyspnea
  – High-risk (fam hx, radiation)

• Not very sensitive / specific
Physical Exam
Physical

- Thyroid exam generally best from behind
- Check for movement with swallowing
Physical

- Complete Head & Neck exam
- Vocal cord mobility (Strobe)
- Palpation thyroid
- Cervical lymphadenopathy
- Ophthalmopathy
Physical

- Physical findings suggestive of malignancy:
  - Fixation
  - Adenopathy
  - Fixed cord
  - Induration
  - Stridor

- Not very sensitive / specific
Graves Ophthalmopathy
Neck Bruising

• Suggests hemorrhage into nodule
Lingual Thyroid
Lingual Thyroid
Table 2. Relation between Clinical Findings and Malignant Thyroid Tumors in 169 Patients with Nodular Thyroid Disease.*

<table>
<thead>
<tr>
<th>Suspected Likelihood of Cancer</th>
<th>% of Patients</th>
<th>% with Malignant Tumor†</th>
<th>Clinical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>44</td>
<td>11</td>
<td>No suspicious symptoms or signs</td>
</tr>
<tr>
<td>Moderate</td>
<td>38</td>
<td>14</td>
<td>Age &lt;20 or &gt;60 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>History of head or neck irradiation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Male sex</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dubious nodule fixation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nodule &gt;4 cm in diameter and partially cystic</td>
</tr>
<tr>
<td>High</td>
<td>18‡</td>
<td>71</td>
<td>Rapid tumor growth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Very firm nodule</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fixation to adjacent structures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Vocal-cord paralysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Enlarged regional lymph nodes</td>
</tr>
</tbody>
</table>

*Modified from Hamming et al.36 with the permission of the publisher; 86 percent of patients had one solitary or a dominant thyroid nodule.

†As determined by fine-needle aspiration biopsy.

‡Two or more highly suspicious symptoms or signs, such as rapid tumor growth, were present in nine patients, all of whom had cancer.
Workup
Serum Testing

• TSH – first-line serum test
  – Identifies subclinical thyrotoxicosis
• T4, T3
• Calcium
• Thyroglobulin
  – Post-treatment good to detect recurrence
• Calcitonin – only in cases of medullary
• Antibodies – Hashimoto’s
• RET proto-oncogene
Serum TSH

High

- R/I Hypothyroidism
  - T₄ (FT₄I)
    - Normal
    - Hypothyroidism
    - Low
      - Subclinical Hypothyroidism

Normal

- Euthyroid

Low

- R/I Hyperthyroidism
  - T₄ (T₃), FT₄I (FT₃I)
    - Normal
    - Low
      - Subclinical Hyperthyroidism
    - High
      - Hyperthyroidism
Fine-Needle Aspiration Biopsy

- Emerged in 1970s – has become standard first-line test for diagnosis
- Concept
- Results comparable to large-needle biopsy, less complications
- Safe, efficacious, cost-effective
- Allow preop diagnosis and therefore planning
- Some use for sclerosing nodules
Fine-Needle Aspiration Biopsy

• Results
  – Benign
  – Malignant
  – Suspicious/Indeterminate
  – Insufficient/Inadequate

• Pooled data from 9 series, 9119 pts:
  – 74, 4, 11, 11%, respectively
Fine-Needle Aspiration Biopsy

• Technique:
  – 25-gauge needle
  – Multiple passes
  – Ideally from periphery of lesion
  – Reaspirate after fluid drawn
  – Immediately smeared and fixed
  – Papanicolaou stain common
Fine-Needle Aspiration Biopsy

• Hamberger study: addition of FNA
  – Changed # pts undergoing surgery 67→43%
  – Carcinoma yield 14→29%
  – Reduced cost per pt 25%

• Campbell & Pillsbury: pooled 10 studies
  – All pts operated on regardless of FNA
    • False neg rate: 2.4%
    • False pos rate: 1.2%
Fine-Needle Aspiration Biopsy

• Problems:
  – Sampling error
    • Small (<1 cm)
    • Large (>4 cm)
  – Hashimoto’s versus lymphoma
  – Follicular neoplasms
  – Fluid-only cysts
  – Somewhat dependent on skill of cytopathologist
FNA of Papillary Ca

- NG: nuclear grooves
- IC: intranuclear inclusions
Imaging
Plain Films

• Not routinely ordered
• May show:
  – Tracheal deviation
  – Pulmonary metastasis
  – Calcifications (suggests papillary or medullary)
Tracheal Deviation

- May be incidentally noted
MRI of Last Patient
Ultrasonography

• Thyroid vs. non-thyroid
  – Good screen for thyroid presence in children
• Cystic vs. solid
• Localization for FNA or injection
• Serial exam of nodule size
  – 2-3 mm lower end of resolution
• May distinguish solitary nodule from multinodular goiter
  – Dominant nodule risks no different
Ultrasonography

• Findings suggestive of malignancy:
  – Presence of halo
  – Irregular border
  – Presence of cystic components
  – Presence of calcifications
  – Heterogeneous echo pattern
  – Extrathyroidal extension

• No findings are definitive
Nuclear Medicine

- Concept
- Uses
  - Metabolic studies
  - Imaging
- Iodine is taken up by gland and *organified*
- Technetium trapped but not organified
- Usually only for papillary and follicular
- Rectilinear scanner (historical interest) vs. scintillation camera
Nuclear Medicine
Rectilinear Scan

- Provided life-size images
- Not common today
Thyroid Hormone Metabolites

- Can give T3 for longer before I-131 ablation
Nuclear Medicine

• Radioisotopes:
  – I-131
  – I-123
  – I-125
  – Tc-99m
  – Thallium-201
  – Gallium 67
Nuclear Medicine

- Technetium 99m
  - Most commonly used isotope (some authors)
  - 99m: “m” refers to metastable nuclide
    - Decay product of Molybdenum-99
    - Long half-life before decaying into Tc-99
  - Administered as pertechnate (TcO4⁻)
  - Images can be obtained quickly
    - “One-Stop” evaluation
  - Hot nodules need f/u Iodine scan
    - Discordant nodules higher risk of malignancy
Hot Nodule
Nuclear Medicine

• Iodine
  – 127 – only stable isotope of iodine
  – 123 – cyclotron product
    • Half-life 13.3 hr
    • Expensive, limited availability
    • Low radiation-exposure to patient
  – 131 – fission product
    • Half-life 8 days
    • Cheap, widely available
    • Better for mets (diagnostic and therapeutic) (high radiation exposure)
  – 125 – no longer used
    • Long half-life (60 days); high radiation exposure with poor visualization
Nuclear Medicine

- Tc-99m versus I-123
Nuclear Medicine

- Thallium-201
  - Expensive, role poorly defined
  - Can detect (but not treat) mets
  - Not trapped or organified – mechanism unclear
    - Potassium analogue
  - Potential advantages:
    - Not necessary to be off thyroid replacement
    - Patients with large body iodine pool (ex: recent CT with contrast) or hypofunctioning gland
    - Can sometimes image medullary
Nuclear Medicine

• Gallium-67
  – Generally lights up inflammation
    • Hashimoto’s
  – Uses in thyroid imaging limited
    • Anaplastic
    • Lymphoma
Nuclear Medicine

• Other imaging agents
  – Tc-99m sestamibi
  – Tc-99m pentavalent DMSA
  – Radioiodinated MIBG
    • Developed for medullary (APUD derivative)
      – Radiolabeled monoclonal antibodies
Nuclear Medicine

• Hurthle-cell neoplasms
  – Better imaged with Technetium sestamibi
    • Concentrates in mitochondria
  – Poorly imaged with iodine
Hot, Warm, Cold

• Study: 4457 patients with nodules
  – All scanned, all surgery
  – Results
  • Cold 84% → 16% cancer
  • Warm 10% → 9% cancer
  • Hot 5.5% → 4% cancer
Hot Nodules

- Most authors feel that hot nodule in hyperthyroid pt has low malignancy risk
- Nodule in clinically hyperthyroid pt may be cold nodule against background of Graves, so scan may help
Other Imaging Modalities

• CT
  – Keep in mind iodine in contrast
• MRI
• PET

• Not first-line, but may be adjunctive
Thyroid Suppression

- Concept is that cancerous nodule is independent of TSH, whereas benign nodule is TSH-responsive.
Thyroid Suppression

• Studies
  – 5 randomized, controlled studies of benign nodules
  – Data suggest that thyroxine not much better than placebo

• Additionally, some malignant nodules regress with suppression
Thyroid Suppression

- Theoretical risk of osteoporosis
  - Highest in post-menopausal women
  - Decreased bone density in some, not all studies
  - No documented increase in fractures
- Controversy – level of suppression
- Many no longer recommend
- Exception – childhood radiation
- Postop / diffuse goiter – different issues
Controversy

• Incidentally-found non-palpable nodule
  – One author’s recommendations:
    • Ultrasound-guided FNA for
      – H/o radiation
      – >1.0 cm
      – Positive family history
      – Suspicious u/s features
    • Else
      – 6-12 mo f/u
  – Of course, keep overall clinical picture in mind
Pearls from an Expert (Mazzaferri)

- No imaging on asymptomatic pts with normal glands by palpation – too many false positives
- Symptoms suggestive of invasion need tissue dx
- Two or more suspicious features (Hamming study) need surgery, regardless of FNA
- Multinodular goiter carries a substantial risk of cancer
- Greater suspicion of nodules in males
- Male over 60: consider surgery regardless of FNA, due to high likelihood of cancer
Flowchart 1

- Most recommend surgery after 2 insufficient FNA’s
Flowchart 3

THYROID NODULE

TSH, THYROXINE (T₄)

HYPERTHYROID  

EUTHYROID

THYROID SCAN

HOT  

COLD

FINE-NEEDLE ASPIRATION (FNA)

MEDICAL TREATMENT

MALIGNANT

SUSPICIOUS

INSUFFICIENT

REPEAT FNA

NEAR-TOTAL/TOTAL THYROIDECTOMY

HEMITHYROIDECTOMY/ISTHMUSECTOMY

PERMANENT SECTIONS

MALIGNANT  

BENIGN

COMPLETION THYROIDECTOMY

SUPPRESSION THERAPY OR NO THERAPY

REPEAT FNA IN 4-6 MONTHS

POSTOPERATIVE EVALUATION AND THERAPY
Management

- Easy in our institution to get FNA and TSH drawn on same day
- I would consider scan in hyperthyroid pt without other surgical indication
Conclusion

• Fine-needle aspiration initial test of choice
• Role for TSH, ultrasound, nuclear scan
• As always, knowledge of pathophysiology and constant vigilance key to optimum patient care


