The incidental adrenal nodule: Evaluation and report

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Objective

1. To review CT/MR of adrenal masses
2. To give radiology’s perspective of the incidental adrenal mass
Adenoma

2 features which allow characterization

1. Lipid content
2. Enhancement and washout
Adrenal Adenomas

Lipid rich

Lipid poor
Lipid Rich Adenoma

- Unenhanced CT
- Chemical shift MRI
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<th>Threshold Value (H)</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
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Boland et al. AJR 1998
Heterogeneous suppression

- 18 patients with adrenal mass that showed heterogeneous suppression
- 6/18 patients had history of malignancy
- All adrenal masses proven benign

Gabriel H et al.  JMRI 2004
What to do?

• No history of malignancy (incidental finding)
  Call it an adenoma

• History of malignancy (lung cancer)
  Old films?
  PET?
Does unenhanced CT = MRI?
MRI vs Unenhanced CT

- MRI is more sensitive (10-30 HU)
- 65% lipid poor adenomas can be characterized with MRI

Israel GM et al. AJR 2004
Haider et al. Radiology 2004
Enhancement Washout

- Adenomas and metastases rapidly enhance.
- Only adenomas rapidly washout.
- Unenhanced, portal, 15 min delay
Washout Calculations

% absolute washout = \( E - D/E - U \times 100 \)
(60%)

% relative washout = \( E - D/E \times 100 \)
(40%)
Adrenal Characterization

99% of population have adrenal glands; adrenal also common site of metastases.

The following evaluation is performed:

1. Adenomas contain lipid and have a rapid washout.
2. Adenomas rapidly wash out.

Technique:

- Injection
- Initial Enhanced attenuation
- Delayed attenuation
- Measure % Relative Washout (adenoma) / % Enhancement (parenchyma)

Characterization:

% Enhancement = Washout

Enhanced attenuation = Delayed Attenuation

Enhanced attenuation = Unenhanced Attenuation

Enter Unenhanced CT attenuation value

Enter Enhanced CT attenuation value

Enter Delayed CT attenuation value

Calculate

Reset
Myelolipoma

- Nonfunctioning benign adrenal tumor
- Hematopoietic tissue and macroscopic fat
- May contain calcification

Dx: Show macroscopic fat in an adrenal mass
Pheochromocytoma

- Adrenal medulla – catecholamines
- ↑catecholamines prior to imaging
- Sporadic or syndromes
  - MEN, VHL, NF
- No definite evidence that α/β blocking is necessary prior to nonionic IV contrast

Bessell-Browne et al. AJR 2007
Mukherjee JJ et al. Radiology 1997
Adrenal Cortical Carcinoma

- Rare
- Usually present as a large mass
- Necrotic
- Calcification
35 y/o female with Cushings, r/o adenoma
Incidental adrenal mass
• Extremely common
• Vast majority - benign/nonfunctioning
• A few are malig/functioning
Challenges

• Unwillingness to accept uncertainty
  - malign/function is extremely unlikely
• Demand for diagnostic certainty
  Fear of malpractice litigation
  Patients/families
  “better safe than sorry”

Berland JACR 2010
Challenges

• Incidental adrenal lesions may be better ignored.
• Further tests will likely yield a benign dx, and could also lead to morbidity.
• But it may represent a malig/funtional lesion and could be life saving.
• 1049 incidental adrenal masses on CT
• Exclusion - known hx of cancer
  funtional pts
  < 1yr imaging f/u or 2 yr clinical f/u
3 Pheo
1 Functional adenoma
1 neoplasm, UMP
American Association of Clinical Endocrinologists and American Association of Endocrine Surgeons Medical Guidelines for the Management of Adrenal Incidentalomas

Zeiger et al.  Endocrine Practice  Vol 15 (Suppl 1) July/August 2009

• Key Recommendations
  – Patients with an adrenal incidentaloma (unless myelolipoma) should undergo clinical, biochemical, and radiographic eval. for signs/symptoms of hypercortisolism, aldosteronism (if hypertensive), the presence of a pheochromocytoma, or a malignant tumor

  – Patients who do not fulfill the criteria for surgical resection need to have radiographic reevaluation at 3 to 6 months and then annually for 1 to 2 years. For all adrenal tumors, hormonal evaluation should be performed at the time of diagnosis and then annually for 5 years
2002 NIH Consensus Panel on Adrenal Incidentaloma

- Biochemical evaluation of every adrenal incidentaloma

- If original work-up negative, repeat serum chemistries & PE every year for 4 years

- Repeat CT at 6 & 12 months

Young, NEJM 2007
Managing Incidental Findings on Abdominal CT: White Paper of the ACR Incidental Findings Committee

Lincoln L. Berland, MD\textsuperscript{a}, Stuart G. Silverman, MD\textsuperscript{b}, Richard M. Gore, MD\textsuperscript{c}, William W. Mayo-Smith, MD\textsuperscript{d}, Alec J. Megibow, MD, MPH\textsuperscript{e}, Judy Yee, MD\textsuperscript{f}, James A. Brink, MD\textsuperscript{g}, Mark E. Baker, MD\textsuperscript{h}, Michael P. Federle, MD\textsuperscript{i}, W. Dennis Foley, MD\textsuperscript{j}, Isaac R. Francis, MD\textsuperscript{k}, Brian R. Herts, MD\textsuperscript{h}, Gary M. Israel, MD\textsuperscript{g}, Glenn Krinsky, MD\textsuperscript{l}, Joel F. Platt, MD\textsuperscript{k}, William P. Shuman, MD\textsuperscript{m}, Andrew J. Taylor, MD\textsuperscript{n}

Incidental Adrenal Mass (≥1 cm) Detected on CT or MR

- Imaging features are diagnostic
  - Myelolipoma, ca** = benign, no F/U
  - HU ≤10 or ↓ signal on CS-MR = adenoma¹

- Imaging features not diagnostic
  - 1–4 cm
    - No history of cancer: consider resection²
    - History of cancer: consider PET or biopsy²

- No prior imaging
  - No history of cancer
    - Benign imaging features³: Presume benign¹, consider 12 month F/U CT or MR
    - Suspicious imaging features⁴
      - Consider PET or below
      - Unenhanced CT or CS-MR
        - HU ≤10 or ↓ signal on CS-MR = adenoma¹
        - HU >10 or no ↓ signal on CS-MR
          - Adrenal washout CT
            - No enhancement (≤10 HU) = cyst or hemorrhage
            - APW / RPW ≥60/40%
              - Benign, no F/U
            - APW / RPW <60/40%
              - Adenoma¹
              - Biopsy if appropriate² or consider CS-MR if not done

- No prior imaging
  - History of cancer

LEGEND
1. If patient has clinical signs or symptoms of adrenal hyperfunction, consider biochemical evaluation
2. Consider biochemical testing to exclude pheochromocytoma
3. Benign imaging features = homogeneous, low density, smooth margins
4. Suspicious imaging features = heterogeneous, necrosis, irregular margins
   APW = Absolute Percentage Washout
   RPW = Relative Percentage Washout
   CS-MR = Chemical Shift MRI
   F/U = Follow-up
Conclusions

• Unenhanced CT, MRI, and washout studies are useful in adrenal mass characterization.
• We can characterize adenomas, myelolipomas, cysts/pseudocysts
• Incidental adrenal mass is common.
• ? Which ones need to be evaluated.