Imaging Evaluation of the Incidental Renal Mass

John R. Leyendecker, MD
Professor of Radiology and Urology Executive Vice Chair of Clinical Operations Section Head, Abdominal Imaging Wake Forest University School of Medicine; Winston-Salem, North Carolina

Objectives:

- Evaluate the incidental renal mass with imaging
- Discuss the advantages and limitations of various modalities for imaging renal masses
Imaging Evaluation of the Incidental Renal Mass

6th Annual Excellence in Urology Seminar

John R. Leyendecker, MD
Professor of Radiology and Urology
Wake Forest University School of Medicine
Winston-Salem, NC
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}

As multidetector CT has come to play a more central role in medical care and as CT image quality has improved, there has been an increase in the frequency of detecting “incidental findings,” defined as findings that are unrelated to the clinical indication for the imaging examination performed. These “incidentalomas,” as they are also called, often confound physicians and patients with how to manage them. Although it is known that most incidental findings are likely benign and
The Problem...

- Cross-sectional imaging of the abdomen is on the rise.
- Virtually every abdominal/pelvic CT has at least one incidental finding.
- Incidental renal masses are frequently referred to urologists for further evaluation/management.

More than half of RCCs are now discovered incidentally.
TSTC

Imaging Evaluation of the Incidental Renal Mass
“...too small to characterize.”

• Many, if not most, radiology reports list “too small to characterize (TSTC) renal lesions” among the findings.
• These are generally in the size range of 1-10 mm depending on collimation.
• The vast majority of these lesions are benign.
Too Small to Characterize

- Less than 1 cm.
- Much lower attenuation than renal parenchyma.
- Cannot get a HU measurement < 20.
- Mostly surrounded by renal parenchyma.
Too Small to Characterize

- There is no consensus on the best way to report these lesions.
- Don’t mention them.
- Report them as “statistically likely benign”.
- Report them as “nonspecific” or “indeterminate”.
- Recommend “attention on follow-up” (usually in oncology patient).
- Work them up (usually only in high stakes patient such as renal donor). → MRI
Not every lesion under 1 cm is too small to characterize.
TSTC? Not with MRI!

Simple cyst
“This lesion is highly concerning for renal cell carcinoma, most likely papillary subtype.”

Papillary RCC
Unenhanced CT

Imaging Evaluation of the Incidental Renal Mass
Unenhanced CT

HU ≤ 20

HU ≥ 70

Homogeneous
No wall

> 1 cm on enhanced CT

Imaging Evaluation of the Incidental Renal Mass
First question

• What are the age, health, and risk factors of the patient?
• The differential diagnosis changes with age.
• Older, sicker patients may be better candidates for surveillance.
• Avoid CT/ionizing radiation in young patients.
• Some patients are at higher risk of malignancy than others.
Second question

Is it cystic or solid?

If uncertain, US can help.
If US not helpful, MRI can help.
Cystic masses

Imaging Evaluation of the Incidental Renal Mass
<table>
<thead>
<tr>
<th>Bosniak Category</th>
<th>Imaging Features</th>
<th>General Population</th>
<th>Comorbidities or Limited Life Expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>I†</td>
<td>Hairline-thin wall; no septa, calcifications, or solid components; water attenuation; no enhancement</td>
<td>Ignore</td>
<td>Ignore</td>
</tr>
<tr>
<td>II</td>
<td>Few hairline-thin septa with or without perceived (not measurable) enhancement; fine calcification or short segment of slightly thickened calcification in the wall or septa; homogeneously high-attenuating masses (≤3 cm) that are sharply marginated and do not enhance</td>
<td>Ignore</td>
<td>Ignore</td>
</tr>
<tr>
<td>IIF</td>
<td>Multiple hairline-thin septa with or without perceived (not measurable) enhancement, minimal smooth thickening of wall or septa that may show perceived (not measureable) enhancement, calcification may be thick and nodular but no measurable enhancement present; no enhancing soft tissue components; intrarenal nonenhancing high-attenuation renal masses (&gt;3 cm)</td>
<td>Observe§</td>
<td>Observe§ or ignore</td>
</tr>
<tr>
<td>III</td>
<td>Thickened irregular or smooth walls or septa, with measurable enhancement</td>
<td>Surgery‡</td>
<td>Surgery‡ or observe§</td>
</tr>
<tr>
<td>IV</td>
<td>Criteria of category III, but also containing enhancing soft tissue components adjacent to or separate from the wall or septa</td>
<td>Surgery‡</td>
<td>Surgery‡ or observe§</td>
</tr>
</tbody>
</table>
Bosniak III, IV

Bosniak III (50-50)
Thick or irregular septa or wall

Bosniak IV (approx. 80% malignant)
Enhancing nodule/solid component
CT vs. MRI

In most cases, Bosniak system works for similarly for both CT and MRI.

MRI will upstage some (10%) cystic renal masses compared with CT.

3T will upstage some renal masses compared with 1.5T.

CT vs MRI

Clear cell RCC
Solid masses

Imaging Evaluation of the Incidental Renal Mass
First question

Does it contain fat?  

HU < -20

- 40 HU
Papillary RCC
Fat free solid mass

**Possibly Benign**
- Small and homogeneous
- Possible fat
- Acute angular interface

**Likely Malignant**
- Large
- Heterogeneous/necrotic
- Vascular invasion

Consider MRI or biopsy

Treat

AML

Mushroom
Not sure?
Consider thin section NCCT or MRI

CT histogram/pixel analysis is controversial
Incidental renal mass in 47 y.o. woman
47 yo woman with mass on CT concerning for RCC

Angiomyolipoma
“Findings highly suggestive of a right upper pole angiomyolipoma that has undergone previous episodes of hemorrhage.”

Plan: Partial nephrectomy

Frozen section: RCC

Surgery: Total nephrectomy

Final path: AML
Renal vein invasion
Incidental Solid Renal Mass
Detected on CT

< 1 cm

- General population
- Limited life expectancy and co-morbidities
  - Follow-up until 1 cm: CT or MRI at 3-6 mo and 12 mo, then yearly

1-3 cm

- General population
- Limited life expectancy or co-morbidities
  - Surgery
  - Follow-up

> 3 cm

- General population
- Limited life expectancy and co-morbidities
  - Surgery
  - Follow-up

Legend:
1. These recommendations are to be followed only if non-neoplastic causes of a renal mass (e.g., infections and fat-containing angiomyolipoma) have been excluded; see Ref. 48 for details. The recommendations are offered as general guidance and do not necessarily apply to all patients.
2. Differential diagnosis includes renal cell carcinoma, oncocytoma, angiomyolipoma. Benign entities are more likely in small renal masses than large ones.
3. Limited life expectancy and co-morbidities that increase the risk of treatment.
4. Interval and duration of observation may be varied (e.g., shorter interval if the mass is enlarging).
5. Probable diagnosis renal cell carcinoma, provided there is no detectable fat at CT or MRI using protocols designed to evaluate renal masses.
6. If hyperattenuating and homogeneously enhancing, consider MRI and percutaneous biopsy to diagnose angiomyolipoma with minimal fat.
7. Surgical options include open or laparoscopic nephrectomy and partial nephrectomy; both provide a tissue diagnosis. Open, laparoscopic, and percutaneous ablation may be considered where available, but biopsy would be needed to achieve a tissue diagnosis. Long-term (5- or 10-year) results of ablation are not yet known.
8. Observation may be considered for a solid renal mass of any size in a patient with limited life expectancy or co-morbidities that increase the risk of treatment, particularly when the mass is small. It may be safe to observe a solid renal mass beyond 1.5 cm; however, there are insufficient data to provide definitive recommendations on the risks and benefits of observation. Thin (≤3 mm) sections help confirm enhancement.
9. Probable diagnosis renal cell carcinoma. Angiomyolipoma with minimal fat, oncocytoma, and other benign neoplasms may be found at surgery.
10. Percutaneous biopsy can be utilized preoperatively to confirm renal cell carcinoma.
Incidental renal mass on CT

**Cystic**
- **BI**
- **BII**
- **BIII**
- **BIV**
  - **Macroscopic fat**
    - **Calcifications**
      - **Treat**
    - **No calcifications**
      - **AML**

**Ultrasound**

**Solid**
- **Equivocal or possibly benign features**
  - **MRI or biopsy**
- **Likely malignant**
  - **Treat**

Adjust recommendation based on size, surgical risk, and life expectancy.
Thank you