Approach to the Incidental Cystic Renal Mass

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Cancer Incidence

Not solely due to imaging
?Tobacco use, obesity...

Diagnostic Problem

• More than half of pts > 50 years of age have at least 1 mass
• Most are seen by radiologists using cross-sectional imaging
• Most are benign
• RCC and benign lesions look alike

Outline

• Techniques
• Differential diagnosis
• Cystic masses (after Bosniak)
• The JACR white paper
• Uncharacterized masses

BWH Renal Mass CT Protocol

64 Channel MDCT with 3 phases

Contrast Material (80cc)

Unenhanced | Nephrographic | Excretory
--- | --- | ---
Range | Kidneys | Kidneys | Abd only
Delay | -- | 100 s | 8 min
Collimation 1.2 mm | 1.2 mm | 0.6 mm
Axial Recon/Incr 3/1.5 | 3/1.5 | 3/3
Post Processing -- | -- | Coronal

Iodinated contrast material (370 mgI/ml); 0.5 s rotation time; AEC w/ quality reference 200 mAs, 120 kVp
What is too small to characterize?

TSTC Definition relates to technique!

Lesion diameter < 2x section thickness

Section thickness ≤ ½ lesion diameter

Section thickness > ½ lesion diameter

Renal Masses – Benefit of Thin Reconstructions

5 mm x 5 mm

3 mm x 1.5 mm

10 mm = Thk x 2

4.5 mm = (Thk x 2) – 1.5

Reconstructing 2.5 mm collimated data at 3 mm thick sections minimizes volume averaging

Renal Masses with MDCT

• Of 44 masses between 5 and 10 mm, 13 (30%) were characterized as cysts on 5/5 mm images, whereas 39 (89%) were characterized as cysts on 3/1.5 images

Jinzaki et al, AJR 2004

Cystic Renal Mass < 1cm

"3 mm cystic renal mass that is too small to diagnose definitively; it is statistically likely to be a benign simple cyst."

Bosniak and Rofsky, Radiology 1996

Silverman SG et al, Radiology 2008

Differential Diagnosis

Consider...

Pseudotumors

Vascular can masquerade as cystic renal cancers!

Infections can masquerade as cystic renal cancers!

Traumatic

Before considering...

Cyst-like

Solid

Cystic Renal Masses (after Bosniak)

<table>
<thead>
<tr>
<th>Cat</th>
<th>Term</th>
<th>Prob %</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Simple</td>
<td>0</td>
<td>proven</td>
</tr>
<tr>
<td>II</td>
<td>Complicated</td>
<td>@0</td>
<td>variable</td>
</tr>
<tr>
<td>IIF</td>
<td>Indeterminate</td>
<td>?</td>
<td>Israel</td>
</tr>
<tr>
<td>III</td>
<td>Indeterminate</td>
<td>50</td>
<td>Aronson</td>
</tr>
<tr>
<td>IV</td>
<td>Solid Features</td>
<td>&gt;95</td>
<td>Curry</td>
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</table>

Israel AJR 2003

Bosniak MA Radiology 1991

Curry AJR 1991

Israel and Bosniak Radiology 2005
**Category I Cyst**

- Well-margined
- Water attenuation (0-20 HU)
- Non-enhancing
- Hair-line thin wall

Benign simple cyst

Ignore

**Category II Cyst**

- Thin and few septa
- Small, border-forming calcification

Benign complicated cyst

Ignore

**Category IIIF Cyst**

- Multiple (more than a few), thin or minimally thickened septa, with perceived enhancement
- Thick / nodular calcification
- Large (>3 cm) hyperdense cyst

Benign multilocular cyst

Follow at 6, 12, and q12 mo to 5 yrs

Interval and duration may be varied

Israel and Bosniak AJR 2003

**Renal Mass MR Protocol**

- T1-w SPGR or FSE
- T2-w FRFSE or SSFSE
- Chemical Shift (In/OOP)
- T1-w SPGR, Fat suppressed, pre + post contrast material
- Subtraction images

**Category I Cyst**

Perceptible wall is acceptable!
Cystic Renal Masses – Bosniak applied to MRI

- Of 69 cystic masses, MR was used to upgrade 7 masses: II to IIF in 2, IIF to III in 3, and III to IV in 2.

MRI most helpful in indeterminate lesions:
- ALL Category IIF and III lesions
- Confirm minimal (<1 cm) cystic masses as simple...

Israel and Bosniak Radiology 2004

Size and Growth...cystic

- Growth is not necessarily predictive (and not part of the Bosniak classification) – Benign cysts grow; cancerous ones may grow little, if at all.
- The smaller the mass, the more likely it is benign.

Silverman SG et al, Radiology 2008

Category III Cyst

- Multiple and thick, enhancing septa; thick wall
- Thick / nodular calcification

Cystic RCC

Surgery

Category IV Cyst

- Nodular /soft-tissue enhancement
- Particularly when apart from wall

Enhancement at CT

- Unequivocal ≥ 20
- Equivocal 10 - 20
- None < 10

Note S.D.

Enhancement at MRI

- Unequivocal ≥ 20 %
- Equivocal 15 – 19 %
- None < 15 %

% = SI Change / Native SI

Ho VB Radiology 2002
Management Recommendations

When a mass smaller than 1 cm has the appearance of a simple cyst, further work-up is not likely to yield useful information.

<table>
<thead>
<tr>
<th>Category</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple, benign</td>
<td>Ignore</td>
<td>Ignored</td>
</tr>
<tr>
<td>Complic, benign</td>
<td>Ignore</td>
<td>Ignored</td>
</tr>
<tr>
<td>Probably benign</td>
<td>Observe</td>
<td>Ignore/Ignor</td>
</tr>
<tr>
<td>Indeterminate</td>
<td>Surgery</td>
<td>Obs/Surgatory</td>
</tr>
<tr>
<td>Malignant</td>
<td>Surgery</td>
<td>Surg/Obsatory</td>
</tr>
</tbody>
</table>

Silverman SG et al, Radiology 2008
Management flowchart...

Berland LL et al, JACR 2010

‘Complex’ on US

- Use US to diagnose simple cysts
- If not simple, often ‘complex’
- Renal Mass protocol CT/MRI
- Use of Doppler and the implementation of FDA-approved contrast agents may allow more cystic masses to be fully diagnosed.

Uncharacterized at NCCT

Can we ignore these masses?

Data from Low Dose Screening CTC...

- 3,001 pts, mean 57 yrs, 1666 F; mean f/u 3.3 yrs
- 433 (14.4%) w/ masses > 1 cm
- Mean 2.5 cm, simple-appearing (<20H) or hyperdense (>70H) except...
- 53 (12.2%) 20-70H; 15 (3.5%) Ca2+; 5 (1.2%) septa
- Four RCCs, all 20-70 HU
- None of the simple-appearing or hyperdense (>70H) masses was RCC

O’Connor et al AJR 2011

How do we report them?

Simple-appearing cyst on unenhanced CT

“It may be appropriate to consider simple-appearing cysts benign on unenhanced CT.”

Radiology Report...

“cystic renal mass statistically likely benign”

Berland et al JACR 2010

Hyperdense mass on unenhanced CT

So long as the mass is small (< 3cm) homogeneously hyperdense, and > 70 HU

Radiology Report...

“Hyperdense renal mass statistically likely benign proteinaceous cyst”
**Uncharacterized at NCCT...**

*Data from a review of RCCs...*

- All 193 RCC had some areas of 20-70 HU and were heterogeneous except for 9% which were homogeneous and measured 20-70 HU

![CT images](image1.png)

Of 193 RCCS, none was homogeneous and < 20 HU or > 70 HU

*Pooler et al AJR 2012*

**How do we report them?**

*Heterogeneous mass on unenhanced CT*

*With any areas measuring 20-70HU...*

**Radiology Report...**

“Heterogeneous that could represent a RCC, or a hemorrhagic or complicated cyst. Renal mass protocol CT or MRI recommended.”