Caveat sonologist
Mistakes to avoid in Kidney Ultrasound

Simon Freeman
Derriford Hospital, Plymouth
simonfreeman@nhs.net
Report: “There is a 4cm solid mass arising from the left kidney likely to represent a RCC”
Is it truly a mass?

- Renal pseudotumours\(^1\)
  - Dromedary/splenic hump
  - Hypertrophied septum of Bertin
  - Persistent foetal lobulation
  - Scarring
  - After partial nephrectomy
  - Splenorenal fusion

- Value of CEUS\(^2\) (but also DMSA, CT and MRI)

The EFSUMB Guidelines and Recommendations on the Clinical Practice of Contrast Enhanced Ultrasound (CEUS): Update 2011 on non-hepatic applications

Authors

List of Abbreviations

Guidelines

European Journal of Ultrasound (Ultraschall in der Medizin)
February 2012
Report: “As an incidental finding there is a column of Bertin in the left kidney”
Hypertrophied Column of Bertin

- 1744 Exupère Joseph Bertin “closisins” of cortex running between the papillae
- Present in up to half of all adults Lt>Rt, often bilateral (18%)
- Can be more than one
- Junction of upper and middle third
- Isoechoic (occasionally echogenic)
- Smooth renal contour
- Pyramid sometimes seen
- Smooth displacement of vessels
- Usually < 2cm
- If in doubt CEUS (or CT/MRI)

Lafortune M. AJR 1986;146:53
Report:

“There is a 4.5cm solid isoechoic mass arising from the interpolar region of the right kidney, likely to represent a RCC”
Not all masses are neoplastic: remember infection

Lobar Nephronia

- Focal pyelonephritis
- May progress to abscess formation
- Can be difficult or impossible to differentiate from a renal malignancy on imaging
- Review the clinical status of the patient
• Acute focal pyelonephritis can be echogenic, mixed echogenicity or echopoor

• Increased echogenicity is most common

Report:

“The right kidney was difficult to identify and may be small, calcified or absent”
Remember that gas is echogenic – missing or disappearing kidney

Emphysematous pyelonephritis

- Kidney can be difficult to find on US, CT is the imaging modality of choice.
- Gas forming organism
- Usually diabetic (90%)
- High mortality if not rapidly diagnosed and treated
- Medical management +/- percutaneous drainage.
- Nephrectomy if not responding

Patel C. Saudi J Kidney Disease 2015;26:764
Report:
“There is a 2cm angiomyolipoma arising from the interpolar region of the right kidney”
Beware of the echogenic mass

RCC

AML
How do we determine echogenicity?

Figure 1. Sonographic patterns of renal cell carcinoma. Our grading scale ranged from 1, being very hypoechoic (cystlike); 2, hypoechoic; 3, isoechoic to renal parenchyma; 4, hyperechoic; and 5, very hyperechoic to renal parenchyma/as echogenic as renal sinus fat.

J Ultrasound Med 2016; 35:311–320

Sidhar K. J Ultrasound Med 2016;35:311
Ultrasound cannot diagnose fat

- Approximately a third of RCC of any size are echogenic relative to parenchyma
- Small RCCs (SRTs) are usually echogenic (77%)\(^1\)
- SRTs in particular are sometimes very echogenic (equal or greater than to renal sinus fat)\(^2,3\)
- Hypoechogenic rim, cystic areas and calcification favour RCC
- Acoustic shadowing favours AML
- Contrast and elastography show possible differences RCC vs AML\(^4\)

Echogenic and <1cm in size

• Unfortunately there is no unequivocal guidance

• “Incidentally discovered echogenic masses <1cm are so likely benign they can be ignored” (no cancers in 120 cases)¹

• 29% of RCC less than 2cm are very hyperechoic²

Bottom Line: US cannot diagnose AML.
CT/MRI is required.

- “All non-calcified echogenic renal lesions detected with US need CT to rule out RCC”\(^1\)
- Clear guidance cannot be given for lesions <1cm but you should have a departmental policy.

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1. Farrelly C. Abdom Imaging 2008;33:44
Report:
“Both kidneys are moderately hydronephrotic, further evaluation with a CT urogram is advised”
Parapelvic cysts can look like hydronephrosis

Parapelvic cysts
• Do not communicate with the collecting system
• Usually asymptomatic
• Often multiple and bilateral
• Do the cystic spaces communicate?
• Are the walls convex?
• Is there a renal pelvis?
• If in doubt an excretion study is needed (IVU, CT, MR)

Tarzamni MK. Cases J. 2008;1:161
Bear Trap 5
Which kidney is obstructed?
Renal Obstruction

• Pelvicalyceal dilatation is not specific for obstruction
  – 26% false positives

Examples
  • Post obstructive dilatation
  • Bladder distension
  • Pregnancy
  • Reflux

• Some patients with obstruction will not have hydronephrosis
  – 35% of patients will not show significant hydronephrosis in the early stages of obstruction, particularly when dehydrated
How can we improve accuracy?

1. Arterial Doppler
   RI > 0.7 or Δ RI > 0.06-0.1
   Physiological measurement of intrarenal pressure

2. Ureteric Jets
   - Only valuable in high grade obstruction
   - Absent jet or continuous low velocity “trickle”
Report:
“...as an incidental finding there is a 3cm diameter simple cyst arising from the lower pole of the left kidney”
Evaluate cysts carefully

Cystic RCC (Bosniak Category IV)
Lymph node metastases

Cysts showing more than minimal complexity (one or two fine septa or minimal calcification) usually require further imaging – CEUS or CT (MRI)
CEUS of complex cysts

- CEUS more sensitive than CT in showing septal and wall enhancement
- CEUS equivalent or superior to CT for categorising complex renal cysts
- Ultrasound tends to upstage lesions in comparison with CT but also downgrades some indeterminate lesions with no enhancement
- CEUS can provide increased confidence that borderline lesions are benign and help to triage lesions equivocal on CT/MRI
- CEUS for Category IIF follow-up

1. Xue L-Y. Abdominal Imaging 2014;39  
2. Quaia E. AJR 2008;191  
3. Park BK. Eur J Radiol 2007;61  
4. Clevert DA. Clinical hemorheology and microcirculation 2008;39  
5. Ascenti G. Radiology 2007;243  
6. Xue L-Y. Abdominal Imaging 2014;39  
7. Barr RG. Radiology 2014::;71  
8. Harvey CJ. Radiographics;2015;35
“Recommended for characterisation of complex cystic masses as benign, intermediate or malignant to provide information for surgical strategy”


<table>
<thead>
<tr>
<th>CEUS Pattern</th>
<th>Classification</th>
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<tbody>
<tr>
<td>No enhancement</td>
<td>Benign</td>
</tr>
<tr>
<td>Occasional bubble or stream of bubbles in a thin septum</td>
<td>Benign</td>
</tr>
<tr>
<td>More complex</td>
<td>Malignant</td>
</tr>
</tbody>
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Adapted from: Barr RG *Radiology* 2014;271
Remember not all solid looking masses are solid.

85 yr. old woman with sudden onset flank pain
70 year old man

Report:
“There are multiple bilateral renal simple cysts, this is likely to indicate polycystic kidney disease”
Don’t over diagnose polycystic kidney disease

- Beware of over diagnosis where there is no family history
- Renal cysts are common in older patients. 9% patients aged >70 have bilateral renal cysts.\(^1\)
- Age and family history are critical\(^2\)
  
  - For ADPKD1 and at risk:
    - Age 15-29: at least 2 cysts
    - Age 30-59: at least 2 cysts in each kidney
    - 60+: at least 4 cysts in each kidney
  - In affected families of unknown genotype:\(^3\)
    - Age 15-39: 3 or more cysts
    - Age 40-59: 2 or more cysts in each kidney
    - Age 60+: at least 4 cysts in each kidney
  - 15% of cases are new mutations. Consider when multiple cysts in a young patient, particularly if cysts also seen in liver/pancreas. Difficult diagnosis and may require genetic testing

Report:
“There is a large simple cyst arising from the upper pole of the left kidney”
Remember duplex kidneys

Weigert-Meyer law:

- With complete duplication the upper moiety has an ectopic insertion medial and inferior to the lower pole moiety (often with a ureterocoele)
- Upper moiety prone to obstruction, lower moiety reflux
Bear Trap 9

Report:

“There is a 7mm diameter simple cyst in the lower pole of the kidney”
Pseudoaneurysms look like cysts - don’t forget the Doppler!

Haematuria following kick in flank during rugby match
Report:

“The transplant is well perfused with blood flow demonstrated in all areas. The resistance index (0.78) is near normal”
Don’t trust the autotrace!

• Automatic calculations are often wrong
• Does the value make sense?
• Look at the pattern not the number!
Conclusions

Avoiding Bear Traps in Kidney Ultrasound

1. Know normal variants and their mimics
   – CEUS is very useful
2. Remember infection
3. Don’t diagnose AML with US
4. Pitfalls in hydrenephrosis
   – Parapelvic cysts
   – Dilatation doesn’t always mean obstruction, obstructed kidneys are not always hydrenephrotic
5. Evaluate cysts meticulously
6. Don’t over-diagnose ADPKD
7. Remember duplex kidneys and pseudoaneurysms
8. Don’t trust the autotrace!