"Incidentalomas" of Kidney Imaging

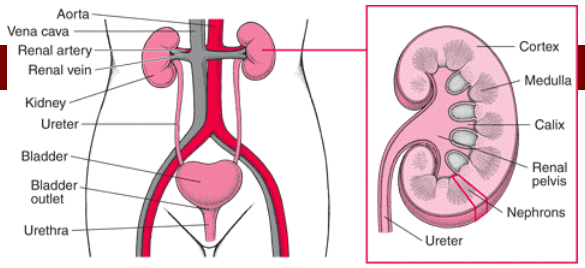
Dr. Richard Braun
Chief Medical Director
Generali USA Life Reassurance

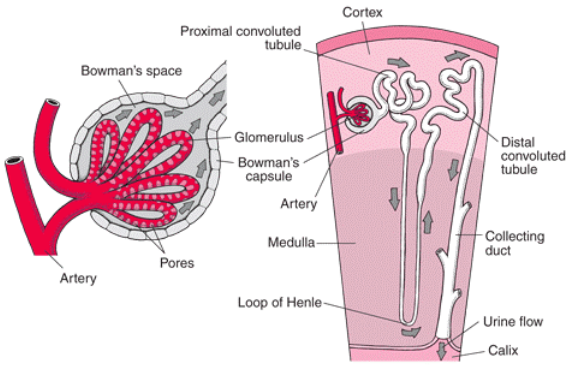
GENERALI USA
Life Reassurance Company

Imaging the Kidney

- Review the Anatomy and Function
- Renal Mass
  - Cysts
  - Solid Mass
- Renal Parenchymal Disease
- Renovascular Disease

GENERALI USA
Life Reassurance Company





Nephron

GENERALI USA Life Reassurance Company

Imaging the Kidney

- **Plain X-ray Kidneys, ureters, and bladder (KUB)**
  - **Can detect calcifications, may detect renal outline if visible**
  - **Should be only the starting point**
- **Intravenous Urography (IVU) a.k.a. Intravenous Pyelography (IVP)**
  - **25-40 mg of iodine (75-150 ml) injected IV as a bolus**

60 seconds after contrast injection

CT

KUB

Taal: Brenner and Rector's The Kidney, *9th ed.*; Chapter 27 - Diagnostic Kidney Imaging

GENERALI USA Life Reassurance Company

Imaging the Kidney

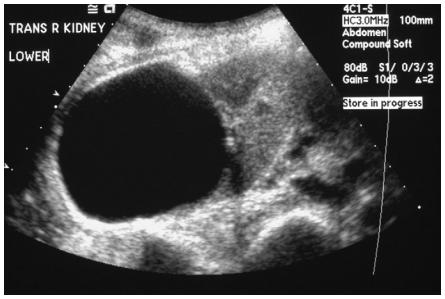
- **Renal Mass**
  - IVP is not a sensitive test for renal Mass
  - Ultrasound is a little better
  - Compared to Computed Tomography (CT)

Mass Size	IVP detects	Ultrasonography
< 1 cm	10%	26%
1-2 cm	21%	60%
2-3 cm	52%	82%
>3 cm	85%	85%

GENERALI USA
Life Reassurance Company

Imaging the Kidney – Renal Cysts

- **Renal cysts – found incidentally**
  - Quite common – Most persons age 60+ will have one or more, found in 50% of people over age 50
  - Rare in those under age 25
  - Usually cortical in location
  - If seen on IVP, Ultrasound (US) is a good follow-up test to characterize
  - If a cyst has septa or internal echoes, a CT or MRI is warranted to evaluate



Taal: Brenner and Rector's The Kidney, *9th ed.*; Chapter 27 - Diagnostic Kidney Imaging

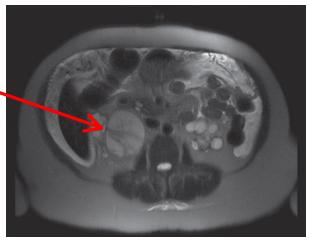
GENERALI USA
Life Reassurance Company

Imaging the Kidney – Renal Cysts

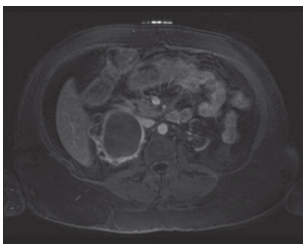
Classification	Description	Risk of malignancy
Bosniak I	Round or oval, thin walled, no septations, 0-20 Hounsfield CT Units, no enhancement with IV contrast	Benign
Bosniak II	As above with a few septations and/or a few calcifications	Very low risk, f/u 6-12 months
Bosniak III	Thick wall, calcifications, Hounsfield density 0-20, no enhancement or nodules	60% chance
Bosniak IV	Thick wall, thick septations, coarse calcifications, Hounsfield Units >20, enhance with contrast	Consider malignant, proceed with work-up

Imaging the Kidney – Renal Cysts

- **Complex cysts contain blood or proteinaceous material, may have density of 50-80, still have thin walls and no nodules**
- **Magnetic Resonance Imaging (MRI) may be superior to CT, especially with subtraction techniques, in differentiating complex cysts from cystic neoplasm**



Complex structure with Septations
T1 weighted



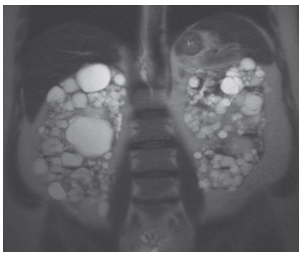
Gadolinium, does not enhance
Needle aspirated – hemorrhagic cyst

Taal: Brenner and Rector's The Kidney, *9th ed.*; Chapter 27 - Diagnostic Kidney Imaging

Imaging the Kidney

- **Autosomal dominant polycystic kidney disease (APCKD)**
  - Accounts for 6-10% of patients on dialysis in the US
  - Begins in the 3rd or 4th decade
  - Pain in the flank, back, or abdomen is the most common complaint
  - If no change in the kidneys or early cysts by age of 19 – unlikely affected
  - If no findings by age 40 – extremely unlikely to be affected

Sonography



CT T2 weighted

GENERALI USA
Life Reassurance Company

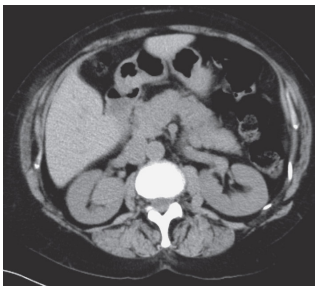
Imaging the Kidney

- **Benign Solid Renal Mass**
  - Renal adenoma is the most common benign neoplasm
    - Corticomedullary in location
    - Almost always < 2-3 cm in size
    - Demonstrate uniform enhancement on CT
  - Hamartomas (angiomyolipomas)
    - Solitary unilateral in women aged 30-50, often painful
    - Multiple, bilateral in those with tuberous sclerosis
    - The presence of Fat in the lesion ensures the diagnosis
    - < 4cm can be monitored, with surgery for symptoms or hemorrhage
  - Oncocytoma
    - Uncommon, benign tumor originating from the epithelium in the proximal collecting tubule
    - Oncocytic renal cell carcinomas occur, and surgery is usually needed to make the diagnosis
  - Fibromas, Myomas, Lipomas, and Hemangiomas are other uncommon, benign tumors of the kidney

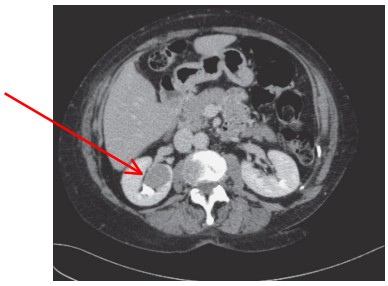
GENERALI USA
Life Reassurance Company

Imaging the Kidney

- **Renal Malignancy**
  - **Renal Cell Carcinoma**
    - **85% of primary renal malignancies**
    - **Usually occurs in the 6th decade, male: female ~ 2:1**
    - **Flank pain, hematuria and flank mass seen in ~ 10%**
    - **Persistent, painless hematuria with negative cystoscopy and IVP needs to have a CT or MRI of the kidneys**



Non-Contrast CT



Nephrographic Phase

Taal: Brenner and Rector's The Kidney, *9th ed.*; Chapter 27 - Diagnostic Kidney Imaging

GENERALI USA Life Reassurance Company

Imaging the Kidney

DIFFERENTIAL DIAGNOSIS OF CHRONIC RENAL PARENCHYMAL DISEASE

•No papillary/calyceal abnormality

•Diffuse parenchymal loss	*Focal parenchymal loss*
•A. Bilateral	
– Chronic glomerulonephritis	Infarct
– Diffuse small-vessel disease	Previous trauma
– Hereditary nephropathies	
•B. Unilateral	
– Renal artery stenosis	
– Post irradiation	
– Rare:	
• Hypoplastic kidney	
• Postobstructive atrophy	

Adam: Grainger & Allison's Diagnostic Radiology, *5th ed.*; CHAPTER 39 Renal Parenchymal Disease, including Renal Failure, Renovascular Disease and Transplantation

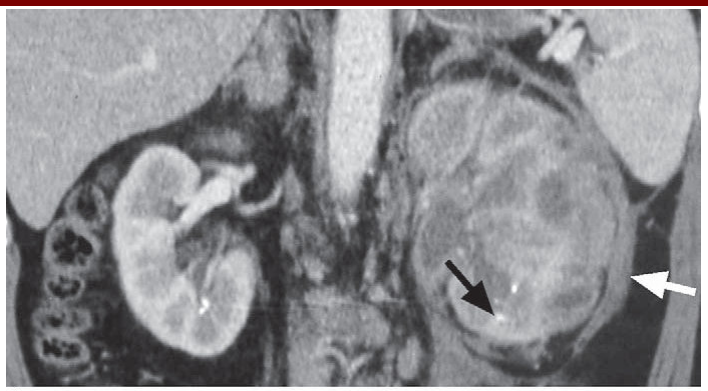
GENERALI USA Life Reassurance Company

Imaging the Kidney

- **Papillary/calyceal abnormality**
- *Diffuse parenchymal loss*
  - Obstructive nephropathy
  - Generalized reflux nephropathy
- *No Parenchymal Loss*
  - Papillary necrosis
  - Tuberculosis
  - Medullary sponge kidney
  - Megacalyces
  - Pelvicalyceal cyst
- *Focal Parenchymal Loss*
  - Focal reflux nephropathy (chronic atrophic pyelonephritis)
  - Tuberculosis
  - Calculus disease

Adam: Grainger & Allison's Diagnostic Radiology, *5th ed.*; CHAPTER 39
Renal Parenchymal Disease, including Renal Failure, Renovascular Disease and Transplantation

Imaging the Kidney



B

Chronic pyelonephritis, dilated calyces, thinned cortex, calcifications,
And surrounding inflammation

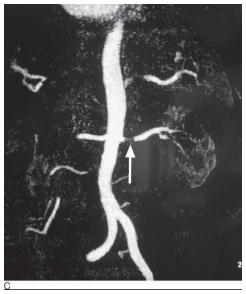
Adam: Grainger & Allison's Diagnostic Radiology, *5th ed.*; CHAPTER 39
Renal Parenchymal Disease, including Renal Failure, Renovascular Disease and Transplantation

GENERALI USA
Life Reassurance Company

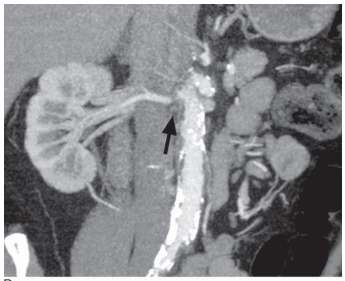
Imaging the Kidney – Vascular disease

- The most common cause of renal artery stenosis is atherosclerosis (70–80%)
- It occurs most often in men over the age of 50 with risk factors for vascular disease
- It usually involves the origin (ostial) or the proximal third of the renal artery
- Plaques within the aorta often cause ostial lesions
- Eccentrically placed atheromatous plaques in the proximal renal artery may also be seen
- If the kidney is small or there are distal plaques, there may be little benefit to intervention

MRA



CTA



Adam: Grainger & Allison's Diagnostic Radiology, *5th ed.*; CHAPTER 39
Renal Parenchymal Disease, including Renal Failure, Renovascular Disease and Transplantation

GENERALI USA Life Reassurance Company

Imaging the Kidney

- Fibromuscular dysplasia (FMD) is the 2nd most common cause of renal artery stenosis (15-20%)
- FMD typically occurs in young women, and should be investigated in a young person with hypertension
- It is a heterogeneous group of conditions, with medial fibroplasia the commonest form
- There are multiple short stenoses and is seen as a 'string of beads' in the distal main artery and major branches, and may be bilateral
- Medial fibroplasia dilates easily at lower pressures with excellent long-term results, while the other types, characterized by smooth stenoses, do not always dilate satisfactorily.

Adam: Grainger & Allison's Diagnostic Radiology, *5th ed.*; CHAPTER 39
Renal Parenchymal Disease, including Renal Failure, Renovascular Disease and Transplantation

GENERALI USA Life Reassurance Company

Imaging the Kidney

- **Renal artery aneurysms are rare**
  - They can be congenital, mycotic, post-traumatic, atherosclerotic, vasculitic or associated with FMD
  - Treat if causing hypertension or if there is a risk of rupture
  - Risk of rupture
    - aneurysm size (> 2.5 cm)
    - the absence of calcification
    - an association with pregnancy.
  - If the aneurysm is at risk of rupture, selective renal arteriography will be necessary to plan the appropriate treatment
- Renal infarction is usually due to thromboembolic occlusion of a renal artery
  - Principal source is atrial fibrillation
  - Others: aortic aneurysm, atheroma, vasculitis or trauma.
  - Clinical presentation: with pain and hematuria
  - Over time, the infarcted area decreases in size, with cortical scar formation
  - In vasculitis there are multiple small infarcts with patchy or wedge-shaped areas of altered perfusion