Tubulointerstitial Renal Disease

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Simple cysts
Simple cysts

- May be multiple
- Usually 1 – 5cm, may be bigger
- Translucent, straw colored fluid
Simple cysts
Clinically, it is important to distinguish between benign cysts and cystic tumors.

Bosniak classification of renal cysts uses radiographic features to determine risk of malignancy.
High risk features

- Thickened, irregular walls
- Multiple septations
- Enhancement of cyst contents with IV contrast
- Calcifications
- Soft tissue component
Bosniak I (~0% malignant)
Bosniak IV (~100% malignant)
Acquired (dialysis-associated) cystic kidney disease
Acquired (dialysis-associated) cystic disease

- With prolonged dialysis patients may form many cortical and medullary cysts
- Clear fluid filled
- Probably result from tubule obstruction due to fibrosis or calcification
Acquired (dialysis-associated) cystic disease

• May develop renal cell carcinoma in cyst wall (7% over 10 years)
Medullary Sponge Kidney
Medullary Sponge Kidney

• Rare developmental abnormality characterized by ectatic or cystic malformations in the medullary collecting ducts resulting in medullary cysts

• Most patients are asymptomatic (incidental radiologic finding)
Medullary Sponge Kidney

• May present with flank pain, recurrent UTIs, hematuria, nephrolithiasis, and nephrocalcinosis

• No specific treatment, and for most patients the condition is benign
Medullary Sponge Kidney
In the normal kidney, the renal medulla is made up of multiple renal pyramids.

The renal pyramids have a striped appearance because of the many small collecting tubules they contain.
In medullary sponge kidney, small cysts develop within dilated collecting tubules of the renal medulla, giving the kidney a sponge-like appearance. The cortex is not involved.
The cysts and dilated tubules seen in medullary sponge kidney can lead to the development of kidney stones.
Normal Intravenous Pyelogram (IVP)
Medullary Sponge Kidney on IVP

“Brush-like pattern”
Nephronophthisis
Nephronophthisis
• Rare disease but the most common genetic cause of ESRD in age <30
• Numerous cysts at cortico-medullary junction
• Research into NPHP led to a Unifying Theme of Cystogenesis and understanding of Ciliopathies
Unifying theme of cystogenesis

Some cell types have motile cilia

All cell types have primary cilia

Credit: Brian Mitchell, Salk Institute
Primary cilia
are present in all cells, including epithelial cells
and all other types. Each cell has only one.
Primary cilia

were previously thought to be a vestigial organ left from flagellates’ “tails”.
Primary cilia

are now recognized as:

• “antennae” receiving information about external events;

• cells’ “communication hubs” transducing this information into decisions regarding proliferation, polarity, differentiation, and tissue maintenance
Primary cilia have several roles:

Sensing role: ciliary receptors are responsible for photosensation, mechanosensation, osmosensation, thermosensation, hormone sensation, and olfactory sensation.
Signaling role: primary cilia have a sophisticated protein transport system supporting intracellular signaling.
Role in maintenance of cell polarity: in kidney, primary cilia respond to changes in flow and maintain cell orientation using intracellular Ca signaling through PC1-PC2 complex.
**Role in cell division:** cilial axoneme originates from the mother centriole of the centrosome.
In mitosis, primary cilium will disassemble and release centrosome, which will orient mitotic spindle in appropriate direction and coordinate cell division.
If cilia are unable to sense cellular orientation, correct mitotic spindle polarity will be lost, resulting in non-directional cell division and distorted architecture of the tubule.
Ciliopathies

• Multiple genes responsible for cystic diseases have been identified to date
• All products of these genes have been localized to primary cilia or centrosome
Ciliopathies

• The general paradigm implicates loss of cell polarity couples with increased expression of ion and water transport proteins in cyst interior

• In many renal cystic diseases other organs are affected (retinal degeneration, liver fibrosis, extra digits, mental defects, diabetes etc)
Polycystic Kidney Disease
ADPKD – Polycystin 1 and 2, function as part of the multi-protein Ca channel complex
ARPKD – Fibrocystin, function unknown
Autosomal Dominant Polycystic Kidney Disease
Autosomal Dominant Polycystic Kidney Disease (Adult)

- Autosomal dominant disease related to defect on chromosome 16 (PKD1, encoding Polycystin 1, 85% of cases) or chromosome 4 (PKD2, encoding Polycystin 2)
- Progressive cystic dilation of nephrons leading to renal failure
1. Abnormal allele of PKD1 or PKD2 does not work;
2. Normal allele produces enough polycystin until it is silenced by some “second hit” resulting in non-directional cell division.
3. The cyst “pinches off” and exhibits autonomous solute and water transport into the cyst which facilitates growth
Autosomal Dominant Polycystic Kidney Disease

- May be asymptomatic until late stages
- Common symptoms are back pain, hematuria, proteinuria, polyuria, hypertension.
Autosomal Dominant Polycystic Kidney Disease

- Kidneys can get up to 4kg
Autosomal Dominant Polycystic Kidney Disease

- ESRD typically by the 4th or 5th decade
Autosomal Dominant Polycystic Kidney Disease

- 40% also have polycystic liver disease (from biliary epithelium)
Autosomal Dominant Polycystic Kidney Disease

- Also intracranial berry aneurysms at the Circle of Willis;
- Lead to death in 4 – 10% of cases due to subarachnoid hemorrhage

http://www.cmi4mri.com
Autosomal Dominant Polycystic Kidney Disease

- Mitral valve prolapse in 20 – 50% (usually asymptomatic)
- 40% die of coronary or hypertensive heart disease
Autosomal Dominant Polycystic Kidney Disease (Adult)

• Dialysis or transplant usually successful, does not recur
• Nephrectomy if painful or infected
Autosomal Recessive Polycystic Kidney Disease (Childhood)

- Rare and distinct from ADPKD

- Defect on chromosome 6 (PKHD1) which encodes protein fibrocytin

- Kidneys are enlarged with smooth external surface
Autosomal Recessive Polycystic Kidney Disease

- Many small cysts on cut section arranged at right angles to cortical surface
- Spongelike appearance
Autosomal Recessive Polycystic Kidney Disease (Childhood)

- Usually presents at birth with serious complications
- Enlarged kidneys may interfere with pulmonary development – stillbirth
- Rapid renal failure may follow

www.ultrasound-images.com/fetal-urogenital.htm
Autosomal Recessive Polycystic Kidney Disease

- Liver also has cysts
- Progressive hepatic fibrosis and bile duct proliferation in older children (“congenital hepatic fibrosis”)
Dysplasia
Multicystic Dysplastic Kidney
Hydronephroisis
Hydronephrosis

Not a cystic disease but is a look-alike
Last (trick) question: what is this?

A. Medullary Sponge Kidney
B. PCKD
C. Hydronephrosis
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