COMMON PEDIATRIC KIDNEY LESIONS

Arya Shariat
MD, PGY2 Pediatrics
Kaiser Los Angeles Medical Center
arya.shariat@gmail.com

Mateen Soleman
DO, PGY4 Diagnostic Radiology
Kaiser Los Angeles Medical Center
USA
Learning Objectives

1. Recognize common kidney lesions in the Pediatric population based on the age of the patient

2. Understand the radiographic findings associated with these kidney lesions

3. Describe the clinical implications
We will discuss kidney lesions in the Pediatric population divided into three age groups: infant (0-2 years old), child (1-12 years old), and teen (11-18 years old).

It is important to divide kidney lesions by age group because the prevalence, presentation, and management of these lesions can vary significantly depending on the age of the patient.

By understanding the specific kidney lesions that are common in each age group and their radiological findings, clinicians can make an accurate diagnosis and provide appropriate management strategies.

Not all kidney lesions require biopsy or further workup. Radiologists and clinicians should work together to determine which lesions require further workup and which lesions can be safely monitored without intervention.
Malignant renal tumors account for 5% of all cancers in children under 15 years old

When dealing with pediatric renal tumors, imaging plays a limited role in determining management as almost all tumors will be resected, with age being a more important predictor of tumor type
1. Neonate

**Nephroblastomatosis**

**Mesoblastic nephroma**

**Rhaboid renal tumor**

Nephroblastomatosis is an abnormality of renal development characterized by persistence of nephrogenic rests. Commonly mistaken for a Wilm's tumor.
Nephroblastomatosis

Characterized by persistent embryologic tissue (nephrogenic rests) in the kidney

Right kidney lobularity with hypoechoic nodularity

Case: Fouryoung rID: 39984

MRI Coronal T2 HASTE with multiple nodular lesions left > right predominantly peripherally located
1. Neonate

Congenital mesoblastic nephroma (CMN) is almost always a benign renal tumor that can be detected antenatally and is most commonly diagnosed before the age of one year.

On imaging, there are no clear characteristics to distinguish it from a Wilms tumor.

Surgical resection via radical nephrectomy is adequate therapy for most patients.
Large heterogeneous solid/cystic mass in the left abdomen with small necrotic areas within the center of the mass.

Multiple cystic structures at the inferior aspect of the mass may represent displaced and distorted renal calyces.

CT with large mass occupying the left abdomen, predominantly cystic in nature centrally, with solid well-defined peripheral margins.
1. Neonate

Malignant rhabdoid tumor of the kidney is a very aggressive malignancy of early childhood with 80% occurring before the age of 2 years old.

Difficult to distinguish from a Wilms tumor, should be considered if the tumor is small and has an infiltrative growth pattern.

4-year overall survival rates of 42% for stages I and II and 16% for stages III and IV.
Large, heterogeneous soft-tissue mass with calcifications being relatively common

Can present with subcapsular fluid accumulation

Tumor lobules are separated by hypoattenuating areas of necrosis/hemorrhage
Most common Pediatric renal mass, accounting for 6-7% of all childhood cancers

Occur mostly between 2 - 5 years

Associated with some congenital syndromes such as WAGR, Denys-Drash, and Beckwith-Wiedemann syndromes (BWS)
CT (venous phase) images are ideal for imaging of a Wilm's tumor after ultrasound. Right sided renal derived mass without internal calcifications. Note the claw sign indicating that the mass arises from the kidney (vs other surrounding structures).

Ultrasound remarkable for 8.2cm right upper quadrant renal mass (green arrowhead)

Case: James Harvey rID: 80200

Case: Ian Bickle rID: 23628
<table>
<thead>
<tr>
<th>1. Wilm's tumor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Angiomyolipoma</td>
</tr>
<tr>
<td>3. Clear cell sarcoma</td>
</tr>
<tr>
<td>4. Multilocular cystic nephroma</td>
</tr>
</tbody>
</table>

Renal angiomyolipoma is a benign tumor commonly sporadic - but in up to 80% of tuberous sclerosis patients. Associated with phakomatosis (von Hippel-Lindau syndrome, neurofibromatosis, Sturge-Weber syndrome). Often an incidental finding.
CT images with multiple fat dense masses in bilateral kidneys, large one measuring \textbf{37x32mm in the mid-portion of the right kidney} in a patient with TS.

Associated with tuberous sclerosis (25-50%), also seen at earlier ages in patients with von-Hippel Lindau syndrome and Neurofibromatosis 1.

More numerous and larger in TS patients vs isolated AML.
Clear cell sarcoma of the kidney is a rare mesenchymal renal tumor.

Accounts for about 5% of primary renal neoplasms in the pediatric population.

Mean age of diagnosis of 3 years old with male predominance.

Also difficult to distinguish from a Wilms tumor.
Initially thought to be a Wilm's tumor, later confirmed to be clear cell sarcoma via biopsy after treatment failure.

Solid pediatric renal tumors often appear similar on imaging and a diagnosis of Wilms tumor is reasonable based on epidemiology, but uncommon lesions should be considered if there are atypical characteristics.

Warning signs: aggressive appearance with large amounts of necrosis, atypical age range (especially newborns), presence of calcifications, and invasion into surrounding tissues. Additionally, bone metastases are a suggestive characteristic of clear cell sarcoma of the kidney.
2. 1-12 years old

- Wilm's tumor
- Angiomyolipoma
- Clear cell sarcoma
- Multilocular cystic nephroma

Rare, noninheritable, benign tumor in children, predominately in boys

CT reveals a well-defined, non-enhancing cystic mass without solid components

Treatment is complete resection either with nephrectomy or nephron-sparing surgery
CT coronal CT+ portal venous phase remarkable for a left upper lobe multilobulated non-enhancing lesion

Left kidney with multiple cysts

Case: Jeffrey Hocking rID: 69676

Signal characteristics:
- T1: variable signal, depending on the protein or blood products of the cysts
- T2: hyperintense (cysts)
- T1 C+ (Gd): septal enhancement may be seen

Case: Hazem M Almasarei rID: 51901
Multicystic dysplastic kidney

Part of differential when considering cystic nephroma

Image: L kidney with multiple cystic structures, without normal renal tissue

- Often diagnosed antenatally with evidence of no functioning renal tissue replaced by multiple cysts
- Normal life expectancy in setting, surgical resection may be performed

If the contralateral kidney is healthy, individuals with MCDK can expect to have a normal lifespan. However, bilateral MCDK is fatal.
Renal cell carcinoma (RCC) is rare in childhood, accounting for less than 0.3% of all childhood tumors.

RCC is the most common renal tumor in adolescents, with an average age of presentation of 10-11 years old.

Variety of radiographic appearances, from solid and relatively homogeneous to markedly heterogeneous with areas of necrosis, cystic change, and hemorrhage.
Large, heterogeneous soft tissue mass in the lower zone of the left kidney with cystic areas, calcifications, and enlarged lymph nodes in the vicinity.
Key Characteristics of common pediatric kidney lesions

Common
Wilm's tumor
Case: James Harvey
rID: 80200

Fat
Angiomyolipoma
Case: Mohammadtaghi Niknejad
rID: 93349

Heterogenous Wilms look-alike
Clear cell carcinoma
Case: Brian Gilcrease-Garcia
rID: 60647

Cystic
Pediatric Cystic nephroma
Case: Hazem Almasarei
rID: 51901
Infants (0-6 months) with renal tumors primarily undergo resection for two possible tumor types: congenital mesoblastic nephroma and rhabdoid tumor of the kidney (MRTK).

Primary nephrectomy is performed for children >9 years old with a higher chance of renal cell carcinoma (RCC) than Wilms tumor.
The role of imaging in children with possible renal tumors is crucial in determining the origin of the mass, looking for signs of an alternative diagnosis, and staging the tumor.

Imaging has limited role in determining management of renal tumors in children; age is a more important predictor of tumor type.

Management decisions need to be tempered with an understanding of the rarity, complexity, and uncertain malignant potential of these masses.
References