Fetal Renal Malformations: The Role of Ultrasound in Diagnosis & Management

Alfred Abuhamad, M.D.
Eastern Virginia Medical School

12 weeks

13 weeks

2nd trimester

Medullary pyramids
Renal Sinus
Cortex

Color Doppler – Renal Arteries
KEY QUESTIONS

• Are there 2 kidneys?
• Is renal size and echogenicity normal?
• Is the bladder visible?
• Is the bladder normal size?
• Are the ureters visible?

Renal Anomalies

Complications of aplasia or migration

Unilateral Renal Agenesis

– Incidence 1:1000
– 50% develop hypertension as adults

– Empty renal fossa
– Compensatory hypertrophy
  • Size >95th
– Color Doppler confirms diagnosis
  • Absent renal artery
– Adrenal gland fills fossa
  • “lying down”
**Unilateral Renal Agenesis**
- Definition: absence of renal tissue

**Bilateral Renal Agenesis**
- Definition: absence of renal tissue
- Epidemiology:
  - Bilateral: 1:3000 births
  - M > F

**Bilateral Renal Agenesis**
- Absent bladder
- Absent renal arteries
- “Lying Down” Adrenals
- Anhydramnios
- Clubfeet
- Pulmonary hypoplasia

**Renal Anomalies**
- Obstructive / Hydronephrotic

**Pyelectasis**
- Pelvis distended with urine
  - > 4mm – up to 31 weeks
  - > 7mm - 32 weeks and greater

**Pyelectasis**
- Antenatal Management
  - Assess risk for aneuploidy
  - Look for other T21 markers
  - F/U u/s after 32 wks

Song J Urol;2007  Lee J Urol;2008
**Uretero-Pelvic Junction Obstruction**

- UPJ
- Renal pelvis obstruction
- Etiology
  - 1/3 of UPJ have accessory crossing vessel

**UPJ Obstruction**

- Epidemiology
  - 1:2000 live births
  - M>F
- Associated Anomalies
  - 25% contralateral renal anomaly
  - 10% bilateral UPJ
  - 10% non GU anomalies

**Ultrasound Findings**

- Moderate to severe hydronephrosis
  - Dilated renal pelvis
  - Dilated calyceal system
  - Enlarged kidney
  - Distension ends at UPJ
  - Normal ureters, normal bladder

**Duplicated Collecting Systems**

- Definitions - renal collecting system split into separate upper & lower pole moieties

- Upper pole drained by ectopic ureter (ureterocele)
- Lower pole drained by normotopic ureter
- Contralateral duplication in 10-20%
- Ectopic ureter inserts inferior and medial in trigone of bladder

Abuhamed UOG
Duplicated Collecting System

Normal Lower Pole  Dilated Upper Pole

Dilated Ureter

Duplicated Collecting Systems

Posterior Urethral Valves

• Definition - urethral membrane acts as valve resulting in bladder outlet obstruction
Posterior Urethral Valves

Ultrasound Findings

– Best diagnostic clue = “keyhole bladder”
  • Distended bladder funnels into dilated posterior urethra
– Ureteral, pelvis and calyceal dilation
– Cortical cysts - 100% predictive for dysplasia

Posterior Urethral Valves

Management

– Offer karyotype
– Termination may be offered
– > 32 wks, worsening oligo consider delivery for valve ablation (?)
– < 32 wks, assess renal function with serial bladder taps (?)

Good Prognostic Indicators

<table>
<thead>
<tr>
<th>Sodium (Na)</th>
<th>&lt; 100 mEq/L</th>
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<tbody>
<tr>
<td>Chloride (Cl)</td>
<td>&lt; 90 mEq/L</td>
</tr>
<tr>
<td>Osmolarity</td>
<td>&lt; 210 mOs/L</td>
</tr>
<tr>
<td>B2 microglobulin</td>
<td>&lt; 4mg/L</td>
</tr>
<tr>
<td>Calcium (Ca)</td>
<td>&lt; 8 mg/dL</td>
</tr>
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<td>Sonographically normal kidneys</td>
<td></td>
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Posterior Urethral Valves

• Management…
  – Consider vesicoamniotic shunt if good prognosis category
  – Vesicoamniotic shunt prevent pulmonary hypoplasia, ?? effect on renal outcome
  – No intervention if AFI normal
  – No improvement in outcome for intervention late in pregnancy

Renal Anomalies

Dysplastic
Multicystic Dysplastic Kidneys

- Definition - renal tissue replaced by cysts
- Epidemiology
  - 1:3,000 live births
  - 5% associated non-renal anomalies

**General Features**
- Best Clue: multiple variable-sized cysts in renal fossa
- Unilateral in 80% (L>R)
- Cysts do not communicate
- Normal renal parenchyma not noted

**PROGNOSIS**
- Unilateral - excellent prognosis
  - Normal AFI, normal bladder
  - Not associated with aneuploidy
  - Non-functioning kidney in 90% (nuclear med scan)
  - Usually involutes (20% 1st yr, 50% by 5yrs)
  - Compensatory hypertrophy of contralateral kidney
  - Rare complications - infection, htn, Wilms tumor

Bilateral
Polycystic Kidneys – Autosomal Recessive

Polycystic Kidneys – Autosomal Dominant