Management of Antenatal Hydrenephrosis

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Prenatal Hydronephrosis

- 3-4 million maternal US performed annually
- Hydronephrosis one of the most commonly detected diagnoses
  - 1 to 4.5% of all pregnancies

SFU Grade 0
Normal renal ultrasound. No splitting of the central echogenic complex (renal pelvis)

SFU Grade 1
Splitting of the renal pelvis only

SFU Grade 2
Dilation of the major calyces

SFU Grade 3
Uniform dilation of the major and minor calyces. No renal parenchymal thinning

SFU Grade 4
Uniform dilation of the major and minor calyces. Renal parenchymal thinning (less than 4 mm or ½ the thickness of the contralateral side)
Antenatal Hydronephrosis

- Basic Principle/Problem
  - Persists after birth in 0.7%
  - Significant uropathy 1:500
  - Dilation ≠ Obstruction ≠ Damage
  - No prospective studies correlating risk of pathology w/degree of ANH

# Severity of Prenatal Hydronephrosis

**Table 3. Defining severity of prenatal hydronephrosis based on AP renal pelvic diameter**

<table>
<thead>
<tr>
<th>Degree</th>
<th>AP Pelvic Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Trimester:</td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>5–8</td>
</tr>
<tr>
<td>Moderate</td>
<td>8–10</td>
</tr>
<tr>
<td>Severe</td>
<td>&gt;10</td>
</tr>
<tr>
<td>3rd Trimester:</td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>7–9</td>
</tr>
<tr>
<td>Moderate</td>
<td>10–15</td>
</tr>
<tr>
<td>Severe</td>
<td>&gt;15</td>
</tr>
</tbody>
</table>

Freilich and Nguyen 2008 AUA Update series
Normal Kidney on US

Normal pyramids, not hydro
Minimal sinus fat
Same echogenicity as liver
NB => newborn may be slightly more echogenic
Evaluation of Hydronephrosis

Evaluate:
- Calyces
- Parenchyma (echogenicity, CM differentiation, cyst)
- AP diameter of the renal pelvis
“In the SFU system, the status of the calices is key” (Fernbach SK et al. Pediatr Radiol, 1993)

- Grade I - only renal pelvis/ no caliectasis
- Grade II - moderate dilation pelvis and major calices
- Grade III – minor calices dilated
- Grade IV - as above but parenchymal atrophy/thinning over calyces
UTD Classification System

Postnatal ultrasound at >48 hours to 4 weeks of age

Obstruction or High Grade Reflux

Physiologic Clinically Not Significant

No Treatment

Avoid Unnecessary Tests, Abx & Surgery

Treatment

Protect renal function
Permit growth & development
Avoid complications
Etiology of Severe Hydronephrosis

- **Duplication anomalies**: 5%
- **Valves**: 1-2%
- **MCDK**: 5%
- **Transient**: 5%
- **UVJ Obstruction**: 5-10%
- **VUR**: 10-30%
- **UPJ Obstruction**: 65%
Hydronephrosis

- Ureteropelvic junction (UPJ) obstruction
- Ectopic ureter
- Ureterocele
- Ureterovesical junction (UVJ) obstruction
- Posterior urethral valves (boys)
- Vesicoureteral reflux
Postnatal Imaging

- Postnatal US (timing – ideally wait at least 48 hours, up to 4 weeks depending on severity of prenatal findings)

- VCUG
  - Numerous studies have demonstrated that reflux occurs in 10-20% of children with antenatally detected hydronephrosis

- Renal Scintigraphy
  - If concerned for obstruction
  - Wait 1-3 months

- MR Urogram
  - Anatomical and functional study
  - Sedation required

Retroperitoneal Ultrasound

- Evaluate with renal bladder US
- Newborns 1st study – day 1 life
  - Initial study may appear normal/dehydration
- Repeat US @ 2 weeks
  - GFR doubles 1st week of life

1 day old

2 weeks old
Not all hydronephrosis is created equally…

- Small intra renal pelvis
  - versus
- Large extra renal pelvis

Intra renal pelvis- less compliant → high pressure to renal parenchyma

Extra renal pelvis- large, compliant → high volume, low pressure
UTD Classification System

Postnatal ultrasound at >48 hours to 4 weeks of age

RISK-BASED MANAGEMENT, POSTNATAL DIAGNOSIS

**UTD P1: LOW RISK**
- **FOLLOW UP US:** 1 to 6 months
- **VCUG:** Discretion of clinician
- **ANTIBIOTICS:** Discretion of clinician
- **FUNCTIONAL SCAN:** Not recommended

**UTD P2: INTERMEDIATE RISK**
- **FOLLOW UP US:** 1 to 3 months
- **VCUG:** Discretion of clinician
- **ANTIBIOTICS:** Discretion of clinician
- **FUNCTIONAL SCAN:** Discretion of clinician

**UTD P3: HIGH RISK**
- **FOLLOW UP US:** 1 month
- **VCUG:** Recommended
- **ANTIBIOTICS:** Recommended
- **FUNCTIONAL SCAN:** Discretion of clinician

The choice to utilize prophylactic antibiotics or recommend voiding cystourethrogram will depend on the suspected underlying pathology

VCUG

- AAP Sections on Radiology and Urology published consensus standardized VCUG protocol
- Importance of cyclic study
- Concern for VUR, ureteroceles, ureteral ectopia, PUV etc
- ALARA and Image Gently
- Parental education prior
- Child-life specialists
Functional Study Diuretic Renogram

- Infants > 4-6 weeks (GFR sufficient)
- Foley to prevent VUR
- IV nuclear tracer MAG-3
- High concern for obstruction (parenchymal thinning)
- Criteria for surgical repair
  - Flat or rising washout curve
  - Half-time > 20 minutes ??
  - Differential function <40%
  - Function loss on serial studies
Magnetic Resonance Urography

- MRU has the unique advantage of providing both functional and anatomic details of urinary tract; useful if degree or location of ureteral obstruction is in question

- Actual renal function may be significantly over-represented in large hydronephrotic kidneys on renal scan

- No ionizing radiation, though often does require sedation
Ureteropelvic Junction Obstruction

- Most common diagnosis associated with *significant* hydro in infants & children
- 1 in 1500 live births
- Prenatal screening – many identified early
- Bilateral < 10%
Post Natal Renal US (3 weeks)

Left

Right
One year later....
Antibiotic Prophylaxis/Stewardship

- Selective CAP – severe hydro, hydroureter are known to increase UTI risk
- Neonates Amoxicillin or Keflex
- Successful empirical treatment protocol should be based on local epidemiology and susceptibility rates

<table>
<thead>
<tr>
<th>Summary Table</th>
<th>Antimicrobial resistance rates in urobacteria$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E. Coli</td>
</tr>
<tr>
<td>TMP-SMX</td>
<td>51.5</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>70.1</td>
</tr>
<tr>
<td>AMC</td>
<td>35.6</td>
</tr>
<tr>
<td>Nitrofurantoin</td>
<td>9.5</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>27.6</td>
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<tr>
<td>Ceftriaxone</td>
<td>12.6</td>
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<tr>
<td>Cefazolin</td>
<td>27.7</td>
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<tr>
<td>Cefazidime</td>
<td>15.3</td>
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<tr>
<td>Gentamicin</td>
<td>14.4</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>9.0</td>
</tr>
<tr>
<td>PTZ</td>
<td>4.1</td>
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<tr>
<td>Imipenem</td>
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<tr>
<td>Aztreonam</td>
<td>11.5</td>
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<tr>
<td>Meropenem</td>
<td>0.2</td>
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<tr>
<td>Ertapenem</td>
<td>0.5</td>
</tr>
<tr>
<td>Amikacin</td>
<td>1.8</td>
</tr>
</tbody>
</table>

$^a$ AMC, amoxicillin clavulanate; PTZ, Piperacillin-tazobactam; TMP-SMX, trimethoprim-sulfamethoxazole. 
$^a$ Data are presented as %.
Parental Compliance w/ CAP Can Be Poor!

- National database of Rx refills
- 35,450 children on CAP for VUR
  - Only 17% were compliant at 1 year

- Not suggesting everyone needs antibiotics, but it is good to know if your patients are compliant

C. Everett Koop, M.D.
"Drugs don’t work in patients who don’t take them"

Key Points

- Prenatal hydro is very common but often spontaneously resolves or lacks significant pathology

- Infants with prenatal hydro should get ultrasound at >48 hours to 4 weeks of life – timing of follow-up US, need for additional imaging determined by postnatal US

- CAP for those with severe hydro, megaureter, known VUR, ureterocele

- Goal is early identification of those with significant pathology to limit unnecessary testing/antibiotics while preserving renal function and limiting infection
Thank You!