Urinary Tract Infections in 2017

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Urinary Tract Infections in 2017

• Disclosures- none

• Learning Objectives
  √ Provide the best and safest care for pediatric patients
    with urinary tract infections (UTIs)
  √ Strategically tailor the evaluation and management of
    individual patients with UTIs based upon current,
    evidence based strategies
  √ Improve the understanding of if and when a patient
    might benefit from a subspecialty referral
Urinary Tract Infections in 2017

- Urinary tract infection
  - Bacterial growth within the urinary tract

- Acute cystitis
  - Lower urinary tract symptoms
    - Dysuria, urgency, new-onset urge incontinence, frequency, lower abdominal pain
    - No fever or low grade (<38)
    - Significant growth of bacteria on urine culture

- Acute pyelonephritis
  - Fever (>38)
  - Abdominal pain, loin pain, symptoms of cystitis
  - Significant growth of bacteria on urine culture, usually a single organism

- Asymptomatic (covert) bacteriuria
  - Significant bacteria on repeated urine samples
  - Asymptomatic patient

- Acute kidney parenchymal injury due to acute pyelonephritis
  - Presence of photon deficient area(s) on technetium-99 dimercaptosuccinic acid (DMSA) renal scan soon after the diagnosis of UTI
  - Hypodense area with internal echoes by ultrasound (US)

- Kidney damage
  - Focal or generalized, persistent kidney damage
    - Reduction of kidney parenchyma with calyceal clubbing on IVP or CT
    - Photon deficient areas and/or decreased uptake by DMSA scan several months after the diagnosis of UTI
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A B

Urinary Tract Infections in 2017

Ultrasoundography of acute pyelonephritis

Renal ultrasoundography in a patient with acute pyelonephritis showing a hypodense mass with internal echoes (outlined by the arrows). Courtesy of Alan Mayer, MD.

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- Epidemiology of UTIs
  - By 7 years of age 8.4% of girls and 1.7% of boys have had one or more symptomatic UTIs
  - UTI is most common in the first year of life with occurrence of boys>girls
  - Prevalence of UTI among 15781 febrile children < 5 years of age presenting to an ER was 3.4%
  - Prevalence of UTI < 3 months of age in uncircumcised boys was 20.1% and was 2.4% in circumcised boys

- 6 most common urinary pathogens
  - Escherichia coli (70%)
  - Proteus mirabilis
  - Klebsiella pneumoniae
  - Enterobacter
  - Pseudomonas aeruginosa
  - Enterococcus (6%)
  - Proteus sp are common pathogens in uncircumcised boys
  - Staphylococcus saprophyticus causes acute UTI in adolescent girls


**Urinary Tract Infections in 2017**

- Clinical sequelae of UTI
  - 193 randomized, stratified patients from a sample of 1161 evaluated following 1st UTI, followed up 6-17 years later
  - No congenital dysplasia or obstruction
  - 15% of 150 who underwent US had kidney damage and/or reduced renal growth
    - These were the patients who had further UTI and VUR grades III-V
  - Nevertheless eGFR and mean SBP and DBP were normal in all participants

Hannula et al., 2012 Arch Pediatr Adolesc Med 166:1117-22

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1. Provide the Best and Safest Care for Pediatric Patients With UTIs

- The best and safest care requires
  - A high index of suspicion of urinary tract infection
  - A proper evaluation
  - Appropriate antibiotic treatment
  - Minimum radiation exposure

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2. Tailored Evaluation and Management of UTIs in Pediatric Patients

- Index of suspicion
  - Fever is the most common symptom of UTI in infants and young children
    - However, UTIs account for fever in <5% of this group
2. Tailored Evaluation and Management of UTIs in Pediatric Patients

- Index of suspicion
  - √ Up to 2 years of age most useful indicators are:
    - Fever > 40
    - Fever for > 24 hrs
    - Prior history of UTI
    - Suprapubic tenderness
    - Ill appearance
    - No other source of fever
    - Lack of circumcision
  - √ Combined predictors were more useful than individual

  Shaikh et al., 2007 JAMA 298: 2895–904       12 studies, 8,837 children

2. Tailored Evaluation and Management of UTIs in Pediatric Patients

- Index of suspicion
  - √ In older children the following increased the likelihood of a UTI in older children
    - Abdominal pain
    - Back pain
    - Dysuria
    - Frequency
    - New onset incontinence

  Shaikh et al., 2007 JAMA 298: 2895–904       12 studies, 8,837 children

2. Tailored Evaluation and Management of UTIs in Pediatric Patients

- Index of suspicion
  - √ Neonates present with
    - Lethargy
    - Poor feeding
    - Jaundice
    - Fever—which may be low grade

  Beetz 2012  Curr Opin Pediatr 24:205–11
2. Tailored Evaluation and Management of UTIs in Pediatric Patients

- A proper evaluation
  - Urine culture is a must
  - Clean void or bladder tap?
    - Systematic review of 5 studies showed wide sensitivity (range 75%-100%) and specificity (range 57%-100%)
  - So what do you do?
    - In individual centers guidelines should probably be based upon local accuracy of voided specimens
  - If severely ill, or unable to obtain voided specimen
    - Use either catheterization or suprapubic aspiration under US guidance

AAP Roberts 2011 Pediatrics 128: 595-610
National Institute of Health and Care Excellence http://guidance.nice.org.uk

2. Tailored Evaluation and Management of UTIs in Pediatric Patients

<table>
<thead>
<tr>
<th>WBC</th>
<th>Gram Stain</th>
<th>Unstained Bacteria</th>
<th>LE</th>
<th>Nitrite</th>
<th>Positive LE</th>
<th>Positive Nitrite</th>
</tr>
</thead>
<tbody>
<tr>
<td># Studies</td>
<td>49</td>
<td>17</td>
<td>22</td>
<td>30</td>
<td>46</td>
<td>13</td>
</tr>
<tr>
<td># Children</td>
<td>66,937</td>
<td>12,530</td>
<td>53,088</td>
<td>12,954</td>
<td>62,671</td>
<td>6,492</td>
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<tr>
<td>Sensitivity</td>
<td>0.74</td>
<td>0.91</td>
<td>0.88</td>
<td>0.79</td>
<td>0.49</td>
<td>0.88</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.86</td>
<td>0.96</td>
<td>0.92</td>
<td>0.87</td>
<td>0.98</td>
<td>0.79</td>
</tr>
</tbody>
</table>

Williams et al., 2010 Lancet Infect Dis 10:240-50

2. Tailored Evaluation and Management of UTIs in Pediatric Patients

- A proper evaluation
  - Commonly a urine culture cutoff of >10^5 CFU/ml is used to distinguish between contamination and a UTI
    - However this is a semi quantitative test
      - Requires a technician to distinguish 100 colonies and culture media plated with 1 ml urine
      - 20% children with a positive suprapubic culture had CFU between 10^3 and 10^4/ml on voided samples
    - The test therefore requires discrimination/judgement on the part of the clinician

Hannson et al., 2003 Lancet Infect Dis 3:180-2
2. Tailored Evaluation and Management of UTIs in Pediatric Patients

- A proper evaluation
  - Cutoff for a catheterized specimen may be more accurately placed at $> 10^4$ CFU/ml
  - Cutoff for a suprapubic is any growth

- Appropriate antibiotic coverage
  - Treatment of cystitis or pyelonephritis requires antibiotic therapy
  - Antibiotic recommendations change over time and should take into account local sensitivity and resistance patterns
  - Overtreatment is a bad idea

- Initial coverage is aimed at *E. coli*
  - 3rd generation cephalosporin
  - 50% or organisms causing UTI are now resistant to ampicillin
  - 30% of organisms causing UTIs are now resistant to trimethoprim and 1st generation cephalosporin
  - *Enterococcus* remains susceptible to ampicillin and is 100% resistant to 1st generation cephalosporin
  - Prior admissions, and prior therapy with 3rd generation cephalosporin or fluoroquinolones is causing an increase in multidrug resistant organisms including extended spectrum β-lactamase producing *E. coli*
2. Tailored Evaluation and Management of UTIs in Pediatric Patients

- **Prophylaxis?**
  - 3 initial systematic reviews or 7, 11 and 12 randomized, controlled trials of children with VUR or recurrent UTIs suggested recurrence of UTI was not affected by this strategy.
  - Meta analysis for risk of bias for allocation and blinding and two subsequent studies showed reduction by prophylaxis, although the benefit was very small—6% over 12 months and 12.6% over 24 months. However, the risk for antibiotic resistance 42% in one and 44% in another.

- **Asymptomatic bacteriuria**
  - Includes follow-up urine cultures in children treated for a true UTI, but who have no symptoms after treatment (so-called test of cure).
  - There is no value in treating this group of infants and children.
2. Tailored Evaluation and Management of UTIs in Pediatric Patients

- National Institute of Health and Care Excellence-2007
  - Recommendations for children < 6 months of age
  - Recommendations for children 6-36 months of age

- American Academy of Pediatrics-2011
  - Recommendations for children 2-24 months of age

- Italian Society of Pediatric Nephrology-2012
  - Recommendations for children 2-36 months of age

<table>
<thead>
<tr>
<th></th>
<th>NICE 2007</th>
<th>AAP 2011</th>
<th>ISPN 2012</th>
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<tbody>
<tr>
<td>Age</td>
<td>&lt;6 months</td>
<td>6-36 months</td>
<td>2-24 months</td>
</tr>
<tr>
<td>US During UTI</td>
<td>Yes, if poor response or atypical UTI</td>
<td>No, unless atypical UTI</td>
<td>Yes, if very unwell</td>
</tr>
<tr>
<td>Later US</td>
<td>Yes</td>
<td>No</td>
<td>Yes, if not performed during UTI</td>
</tr>
<tr>
<td>DMSA scan at 4-6 months</td>
<td>No unless atypical UTI</td>
<td>No unless atypical UTI</td>
<td>No recommendation</td>
</tr>
<tr>
<td>VCUG</td>
<td>No, unless atypical UTI or abnormal US</td>
<td>No, unless US abnormal</td>
<td>No unless US abnormal</td>
</tr>
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</table>

In Summary

- Appropriate identification and antibiotic treatment is the most important management need for children with UTI.
- In the rare case that a UTI is secondary to obstructive uropathy, it will be detected on US.
- Only rarely does permanent kidney damage follow UTI and very few of these children appear to develop hypertension of CKD.
- It follows that very few children with UTI require extensive imaging of their urinary tract.
- Further investigations and urinary tract prophylaxis should only be considered in children with severe or atypical initial episodes of pyelonephritis or recurrent UTIs, especially if associated with fever.
Referral?

- Referral for further investigations and urinary tract prophylaxis should be strongly considered in children with severe or atypical initial episodes of pyelonephritis or recurrent UTIs, especially if associated with fever.
- Referral at any point along the way is completely warranted.

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