



PYELONEPHRITIS

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- A 19mo infant girl was seen in the ED 3 days ago and diagnosed with a UTI. She was afebrile at the time and discharged on broad spectrum antibiotics. The child returns to the ED with a fever of 39.5 and vomiting. Her culture from her first visit shows >100,000 cfu of pan-susceptible E.coli.



- Upon further question, mom states she was unable to acquire the antibiotics until this morning. The best course of action in this case is to:
 - A. Give one dose of Ceftriaxone in the ED and discharge home with oral antibiotics.
 - B. Discharge home with oral antibiotics and follow up at PCP in 48 hours.
 - C. Obtain a renal ultrasound and admit to the general team.
 - D. Call DCF, this mom is clearly unfit to take care of her child.
 - E. Give one dose of Ceftriaxone in the ED, obtain a renal ultrasound, and admit to the general team.



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PYELONEPHRITIS

- Severe infectious inflammatory disease of the renal parenchyma, calices, and pelvis that can be acute, recurrent, or chronic.
- aka upper urinary tract infection
- Complicated infections can result from underlying medical problems (i.e. HIV, diabetes), GU anatomic abnormalities (renal stones), and/or multidrug resistant bugs.
- In older children, we assume pyelonephritis in the setting of fever, unilateral flank pain, and urinalysis consistent with UTI.
- In younger children, flank pain is seldom seen.



EMPIRIC THERAPY FOR UTI:

- Must provide adequate coverage for *E.coli*
 - Based on our antibiogram Augmentin 72%, Levaquin 87% (keeping in mind concern for safety in children), and Bactrim 55%
- Suggestions include **third generation or greater cephalosporins** (i.e. cefixime, cefdinir) for children without GU abnormalities
- Amoxicillin or ampicillin should be added if Enterococcal infection is suspected



INDICATIONS FOR HOSPITALIZATION IN CASES OF UTI/PYELONEPHRITIS:

- Age < 2 months
- Clinical urosepsis (i.e. toxic appearance, hypotension, poor capillary refill)
- Immunocompromised patient
- Vomiting or inability to tolerate oral medication
- Lack of outpatient follow-up
- Failure to respond to outpatient therapy



- In patients who worsen or fail to improve within 48 hours, **renal and bladder ultrasound** should be performed as soon as possible to evaluate for the presence or absence of a renal abscess or surgically correctable anatomic abnormality, or obstruction.



The patient receives Tylenol and antibiotics in the ED and is waiting to get her renal ultrasound.

The floor team evaluates the patient and suggests the addition of steroids to decrease renal parenchymal inflammation and scarring. They would like your opinion on steroids.

Do you:

- Agree to give steroids – they can't hurt right?
- Defer to their team – it's their patient anyway.
- Consult the literature – PubMed and UpToDate have all the answers.
- Who gives steroids for UTI?!



THEY WOULD LIKE YOUR OPINION ON STEROIDS. DO YOU:

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- The role of renal parenchymal inflammation and renal scarring has been evaluated and a clinical trial by the NIH is ongoing.
- An observational study by Pohl et al. suggested that **dexamethasone decreased urinary levels of IL-6 and IL-8 in children**. These interleukins are thought to lead to renal scarring.
- An additional trial was conducted by Huang et al. in 84 children less than 16 years old with their first episode of acute pyelonephritis and high risk of renal scar formation. Huang et al. randomly assigned their participants to receive oral methylprednisolone or placebo in addition to antibiotics. **Treatment with methylprednisolone was associated with decreased renal scarring at 6 months** without significant adverse effects.
- **Stay tuned for the results of the Corticosteroids for Children with Febrile Urinary Tract Infections (STARRS) trial by NIH.**



The risk of renal scarring increased with recurrent episodes of pyelonephritis.

- After the first episode, the risk is 5%
- After the second episode, the risk is 10%
- After the third episode, the risk is 20%
- After the fourth episode, the risk is 40%
- After the fifth episode, the risk is 60%



RENAL ULTRASOUND

- Recommended for
 - Children <2yo with first febrile UTI
 - Children any age with recurrent febrile UTI
 - Children any age w/ UTI who have family hx of renal or urologic disease, poor growth, hypertension
 - Children who do not respond as expected to appropriate antimicrobial therapy



RENAL ULTRASOUND

- A renal ultrasound can demonstrate all of the following, except:
 - A. Size and shape of the kidneys
 - B. Vesico-ureteral-reflux
 - C. Duplication and dilation of the ureters
 - D. Peri-renal or renal abscess



- Renal ultrasound can demonstrate the **size** and **shape** of the kidneys, the **presence of duplication** and **dilation** of the ureters, and the existence of gross **anatomic abnormalities**. Renal ultrasound can also identify renal or perirenal **abscess** or **pyonephrosis** in children with acute UTI who fail to improve on therapy.
- However, it is not reliable for detecting renal scarring or vesico-ureteral reflux. For that, you need a VCUG and/or renal scintigraphy with DMSA.
- Does this patient's presentation warrant VCUG?



VOIDING CYSTOURETHROGRAM

- VCUG should be used to evaluate for VUR:
 - Children of any age with **2 or more febrile UTIs**
 - Children of any age with a first febrile UTI who have a **family history of renal or urologic disease**
 - Children with **poor growth or hypertension**
 - Children with UTI caused by **pathogens other than *E.coli***

Therefore, with first febrile UTI, VCUG is not indicated.



VOIDING CYSTOURETHROGRAM

- Test of choice to establish the presence and degree of VUR.
- Approximately 40% of young children with an initial febrile UTI have VUR.
- Utility of routine VCUG controversial:
 - Risk of renal scarring is increased in children with VUR compared with children without VUR and risk increases with higher grades of VUR.
 - It is unclear whether benefits of detection and treatment of VUR outweigh the risks.
- If VCUG demonstrates grade 3 or higher VUR, antimicrobial prophylaxis should be initiated.



RENAL SCINTIGRAPHY

- Using dimercaptosuccinic acid (DMSA), can be used to detect acute pyelonephritis.
- DMSA is injected via IV, uptake by the kidney is measured 2-4 hours later. Areas of decreased uptake represent pyelonephritis (or scarring in a chronic UTI)
- Use of scintigraphy is controversial. There is exposure to radiation and most children with febrile UTI have pyelonephritis and positive DMSA which may lead to identification of children who may or may not be at risk for future UTI.



RISK OF RECURRENCE

- In children <6 yo, risk is increased in
 - Caucasian children
 - Age 3-5 years
 - Grade IV to V VUR

INDICATIONS FOR REFERRAL

- Dilating VUR (Grade 3 to 5) or obstructive uropathy
- Renal abnormalities
- Impaired kidney function
- Elevated blood pressure
- Bowel and bladder dysfunction refractory to primary care measures



REFERENCES

- Acute Management, Imaging, and Prognosis of Urinary Tract Infections in Infants and Children Older than One Month. *UpToDate*, Last updated 10/30/13
- Pohl HG, Rushton HG, Park JS, et al. Adjunctive oral corticosteroids reduce renal scarring: the piglet model of reflux and acute experimental pyelonephritis. *J Urol* 1999; 162:815.
- Huang YY, Chen MJ, Chiu NT, et al. Adjunctive oral methylprednisolone in pediatric acute pyelonephritis alleviates renal scarring. *Pediatrics* 2011; 128:e496.
- Corticosteroids for Children with Febrile UTI
<http://clinicaltrials.gov/ct2/show/NCT01391793>
- Baren. "UTI in children and Adolescents." *Pediatric Emergency Medicine*. 2008.

