

PedsCases Podcast Scripts

This is a text version of a podcast from PedsCases.com on “Urinary Tract Infections - CPS Podcast.” These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at www.pedscases.com/podcasts.

Urinary Tract Infection in Infants and Children – CPS Podcast

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Hello, my name is Dr. Chris Novak, I’m a pediatric resident at the Stollery Children’s Hospital in Edmonton Alberta. This podcast was produced by PedsCases and the Canadian Paediatric Society and will be discussing the CPS Position Statement “Urinary Tract Infection in Infants and Children: Diagnosis and Management.” This podcast was developed with Dr. Joan Robinson, the lead author this statement. She is a Pediatric Infectious Disease Specialist, and Professor at the University of Alberta.

The diagnosis and management of urinary tract infections (UTIs) in children has led to considerable controversy over the years. Children will be miserable until their UTI is treated and could even develop sepsis. However, in the era of antimicrobial stewardship, physicians are now more aware than ever about the need to avoid the use of inappropriate antibiotics. Accurate diagnosis of UTIs and related genitourinary anomalies such as vesicoureteral reflux (VUR) can require invasive and uncomfortable procedures like bladder catheterization and voiding cystourethrogram (VCUG). This has left physicians with important questions about how to balance risks, antimicrobial stewardship, and invasive investigations when caring for kids with UTIs. In 2014, the Canadian Paediatric Society released updated guidelines to try and answer some of these questions.

Objectives

By the end of this podcast the learner should be able to:

1. Recognize the clinical features of UTIs in infants and children
2. Order appropriate investigations to diagnose UTIs
3. Know when to order antibiotics and what to consider initial empiric management.
4. Understand when to investigate for vesicoureteral reflux or structural anomalies of the urinary tract.

This podcast will focus on UTIs in children older than 2 months of age. For an approach to the management of younger infants, check out our PedsCases podcast on the

approach to fever in an infant. Children with recurrent UTIs, structural renal abnormalities or other complex health conditions require individual considerations which are beyond the scope of this podcast.

Clinical Case

Let's start with a case:

You are working in a community emergency department and you go in to see Lincoln, a 5-month old male presenting with a fever. Lincoln has been fussy for the past 3 days with tactile fevers, and today began vomiting after feeds. He has no cough, congestion, or diarrhea, but has decreased urine output today.

On exam, the patient is febrile with temperature of 38.8 degrees Celsius. He has moderate tachycardia and dry mucous membranes. He is crying but has no clear focus of infection on exam with no nuchal rigidity, clear lungs, a soft abdomen, normal tympanic membranes, and no rashes. He has normal uncircumcised male genitalia. With no clear focus of infection, you wonder what to do next. Could this be a UTI?

Background and Epidemiology

The term UTI applies to all infections of the urinary tract. Lower urinary tract infections are referred to cystitis and infections of the kidney are called upper tract infections or pyelonephritis. Differentiating lower from upper tract infections clinically is difficult but if a child has fever with a UTI, we assume that they have pyelonephritis. Common bacteria which cause both lower and upper tract infections include *E. coli*, *Klebsiella pneumoniae*, *Enterobacter*, *Citrobacter*, and *Serratia*. In adolescent females, *Staphylococcus saprophyticus* (a type of coagulase negative staphylococci) can also cause UTI.

UTIs are relatively common, especially in the first two years of life. For children 2-24 months of age presenting with fever without a source about 7% of them will have a UTI. Risk factors for UTI include female sex, Caucasian ethnicity, and uncircumcised males. All studies have shown that circumcised males have lower rates of positive urine cultures than do uncircumcised males. However, bacteria build up under the foreskin so contaminated urines are probably more common in uncircumcised males so some of these positive urines may not represent UTIs. Even if they are all UTIs, since UTIs are quite uncommon in males as compared to females, the absolute difference between circumcised and uncircumcised males is relatively small. One study estimated that over 100 boys would need to be circumcised at birth just to prevent one UTI! Females are prone to UTIs throughout their life span. In males older than 3 years it is very unusual for them to get a UTI in the absence of urinary tract instrumentation or a previous history of UTI.

Clinical Features

For children less than 3 years of age, the most common presentation of a UTI is a fever $>39^{\circ}\text{C}$ with no apparent source. They may also have irritability, poor feeding, or vomiting. Older children will typically present with the same urinary symptoms that an adult would get. These include dysuria, frequency, urgency, abdominal or flank pain, and new onset of urinary incontinence.

In pre-pubertal girls, it is very common to get dysuria and irritation of the vulva from bubble bath or poor hygiene. On exam, the external genitalia will look slightly inflamed. These girls will have negative urine cultures and do not have a UTI so do not require antibiotics. In general, a urinary tract infection should not cause irritation of the external genitalia!

Clinical Case

Given Lincoln's fever with no apparent source, you need to rule out a urinary tract infection. In order to test for this, you explain to the family that you will need to collect a urine sample using an in-and-out catheter. His mom exclaims "You want to do what???"

Investigations

The diagnosis of a UTI is based on urinalysis and urine culture. A urinalysis acts as a rapid screening testing. Children with an abnormal urinalysis and compatible symptoms warrant treatment with antibiotics pending culture results. The urine culture will then confirm the diagnosis within the next 48 hours if it grows bacteria. A blood culture is only indicated if the child is hemodynamically unstable, and creatinine only needs to be checked in a complicated UTI or if the child stays on an aminoglycoside for more than 48 hours.

The CPS recommends that a urinalysis and culture be obtained from all children less than 3 years of age presenting with a fever without a source. For children with cough, congestion, wheeze or diarrhea, their fever is unlikely to be due to a UTI and urine testing is not required. In fact, positive urine cultures in children with these symptoms are more likely to be contaminants or asymptomatic bacteruria that do not require treatment.

For toilet-trained children, a mid-stream urine sample can be collected. Girls should be asked to sit backwards on the toilet which separates the labia and perhaps decreases the risk of contamination. Unfortunately, collecting urine from children that are not toilet-trained is not an easy task. We have a few options. The first, and least invasive choice is a bag urine, where an adhesive bag is attached to the infant to wait until the child pees. While these samples work well for urinalysis, bag samples unfortunately have rates of bacterial contamination up to 63% even with best efforts to clean the perineum. With these high rates of contamination, the urine culture from a bag sample cannot be interpreted, and is more likely to be a false positive than a true indication of infection. For more accurate urine cultures, the next options are in-and-out urine catheterization and suprapubic aspiration. Suprapubic aspiration is rarely practiced in most settings, so

an in-and-out catheterization is usually the way to go. For families uncomfortable with bladder catheterization, a reasonable approach is to first collect a bag sample, and then if the urinalysis is abnormal, proceed to a catheter sample for urine culture.

There are some recent studies looking at clean-catch methods for young infants. These involve holding the infant and doing various maneuvers to stimulate the infant to pee, while trying to catch the urine.

Once you get results back from a urinalysis, there are several markers to look at. On macroscopic examination positive nitrites and leukocyte esterase are suggestive of UTI. On microscopic examination, the presence of white blood cells (AKA pyuria) or visible bacteria are suggestive of a UTI. Each of these markers on their own will have false positives and false negatives. However, a child with negative nitrites, leukocyte esterase, pyuria and bacteruria has a <1% chance of having a UTI. For more details about different aspects of the urinalysis, there is a good table in the CPS Statement.

The urine culture results should come back within 48 hours. A positive urine culture from an appropriate sample with enough bacteria of one type confirms the diagnosis of a UTI. It is confusing as American publications report urine colony counts per mL instead of per L with 10^8 per L equaling 10^5 per mL. From a clean catch specimen, greater than 10^8 colony forming units (CFUs) per liter suggests a UTI. For an in and out catheter specimen, you need slightly less bacteria, at $>5 \times 10^7$ CFU/L. Unfortunately, the lab will often round the report to the nearest log, so clinicians have to decide whether or not to use 10^7 or 10^8 as a cut-off based on the patient's clinical picture. As a reminder, a positive culture from a bag urine cannot really be interpreted. Urine cultures with mixed growth or low colony counts are usually contaminants and do not require treatment.

Treatment

Patients with compatible symptoms and a suggestive urinalysis warrant treatment with antibiotics while you wait for culture results. The first decision to make is whether to treat with oral or IV antibiotics.

Given their increased risk of sepsis or other serious invasive infections, infants 2-3 months of age typically require initial treatment with IV antibiotics. Oral antibiotics are appropriate for most other children with febrile UTIs. Children who are not tolerating fluids or oral medications, appear toxic, or have known major urologic abnormalities generally require initial treatment with IV antibiotics, but can be stepped down to oral when they clinically improve. The total course of IV and oral antibiotics should be 7-10 days for pyelonephritis.

Older children with UTI and no fever are likely to have simple cystitis and can be treated with a short course of 2-4 days of oral antibiotics.

Antibiotic selection should be based on local resistance patterns. In most areas, Cefixime is a good choice for oral antibiotics, and gentamicin or ceftriaxone or cefotaxime are a good choice for IV antibiotics. Gentamicin can be nephrotoxic or ototoxic, but both are unlikely with a short course. In most Canadian centers, gentamicin is more likely to cover resistant organisms than are the cephalosporins. Once a specific organism is isolated in the urine culture and susceptibilities are known, antibiotics should be changed to the most narrow spectrum choice if the patient is still in hospital. If the patient has been discharged, the antibiotic should be changed if the bacteria is resistant to the antibiotic that they went home on and the child is still symptomatic.

Clinical Case

You collect a urine sample from Lincoln using an in-an-out cath. The urinalysis shows 2+ Leukocyte Esterase, and >50 WBC per high powered field. Given his symptoms and urinalysis you decided to start antibiotics.

Lincoln has been vomiting after feeds, and you worry that he will not tolerate oral antibiotics. You opt to admit him to hospital and start empiric IV antibiotics with Gentamicin. The urine culture comes back positive for 10^8 CFU/L of E. coli. After 3 days, Lincoln is afebrile, drinking well and is ready to step down to oral antibiotics.

His mom asks, "Is Lincoln at risk of having more urinary tract infections in the future?" Do you need to do any further investigations?

Imaging in UTI

An important consideration unique to pediatric UTI is whether or not the child has a urinary tract abnormality that puts them at increased risk of further UTIs. Children with these abnormalities may be eligible for prophylactic antibiotics or surgical treatment.

Significant urologic abnormalities include vesicoureteral reflux (VUR) and obstructive uropathies. VUR is where urine is able to flow backwards from the bladder through the uterovesical junction up towards the kidneys. VUR predisposes patients to serious UTIs as it can lead to stagnant pooling of urine and can introduce bacteria into the kidney. As VUR gets more severe, it can lead to dilation of the ureter and hydronephrosis. Grade IV and V VUR cause hydronephrosis and have a high risk of recurrent UTI.

The CPS recommends testing all children <2 years of age after their first febrile UTI with a renal ultrasound. A renal ultrasound is a good screening test that can detect major renal abnormalities, or grade IV or V VUR with hydronephrosis where patients are likely to benefit from prophylactic antibiotics.

A voiding cystourethrogram (VCUG) is a more invasive test that involves injecting contrast fluid into the bladder through a catheter. VCUG is more sensitive than ultrasound at detecting VUR, however most children with grade I-III VUR are not likely

to benefit much from antibiotic prophylaxis. Based on this, the CPS now recommends that most children <2 years of age with a normal ultrasound only be assessed with a VCUG after their second febrile UTI. This recommendation significantly reduces the number of children who need VCUGs and still effectively catches most children with high-grade VUR on renal ultrasound.

Clinical Case

Lincoln goes ahead with a renal bladder ultrasound. The ultrasound shows right-sided hydronephrosis, suggestive of Grade IV or V VUR. You refer Lincoln to a Pediatric Urologist for further assessment of VUR and consideration of surgical management or prophylactic antibiotics. Lincoln is discharged home on oral Cefixime and completes a total 7-day course of antibiotics.

Summary

This concludes our podcast on UTI in children. Let's wrap up with a few key take-home points:

- 1) Consider UTI in all children less than 3 years of age with a fever without a source. In older children ask about urinary symptoms and look for abdominal or flank pain on exam.
- 2) In children who aren't toilet-trained, urinalysis and culture should be collected with an in-and-out catheter for the most accurate diagnosis.
- 3) Children who are not toxic and can tolerate PO meds can be treated with PO antibiotics. For unwell children start IV antibiotics, and step down to oral once they improve.
- 4) All children <2 years of age should have a renal ultrasound after their first febrile UTI to assess for risk of recurrent UTIs.

This concludes the podcast. Thank you to Dr. Robinson for her input and stay tuned for more PedsCases podcasts!

References

- 1) Robinson J, Finlay JC, Lang ME, Bortolussi R. Canadian Paediatric Society, Community Pediatrics Committee, Infectious Diseases and Immunization Committee. Urinary tract infection in infants and children: Diagnosis and management. Jun 13 2014.
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