Section of Pediatric Urology at Nationwide Children's

Management of Urinary Tract Infections in Children

The Section of Pediatric Urology at Nationwide Children's Hospital provides comprehensive diagnostic and therapeutic services for a wide range of urological disorders in children of all ages and teens, as well as consultations for urinary tract abnormalities detected in utero. Inside this practice tool, look for information about the management of urinary tract infections in children: age and gender-specific diagnosis, evaluation and treatment.

U.S.News America's Best Children's Hospitals 2009-10

Urology Ranked #12 in the Nation by *U.S.News*

Nationwide Children's Hospital℠

Pediatric Urology at Nationwide Children's Hospital

From conditions which primarily require accurate diagnosis and therapy to those requiring major reconstructive surgery or ongoing support, Nationwide Children's Hospital offers expertise and solutions.

- Our diagnostic facilities include a complete urodynamics laboratory and comprehensive diagnostic radiographic and radionuclide evaluation.
- Services range from primary urologic care to major reconstructive surgery of the urinary tract, genitalia and/or urinary sphincter.
- Our team of experts includes leading pediatric urologists; our surgical staff support team also includes a stoma therapist, a nurse practitioner and urodynamic technical and nursing staff.
- We can also offer outreach and support, including support groups for bladder exstrophy and other major urological disorders.

PHYSICIAN TEAM

Seth A. Alpert, MD, is a member of the Section of Pediatric Urology at Nationwide Children's Hospital and also a Clinical Assistant Professor of Urology at The Ohio State University College of Medicine. He received his medical degree from George Washington University School of Medicine, Washington, D.C. He completed urology residency at the University of Tennessee, Memphis, followed by a two-year pediatric urology fellowship at Children's Memorial Hospital, Chicago. Dr. Alpert is interested in all aspects of urologic problems in children including such diverse conditions as urinary tract infections, hydronephrosis, urinary incontinence, hypospadias, kidney stones and ureteral reflux.

Venkata R. Jayanthi, MD, is a member of the Section of Pediatric Urology at Nationwide Children's Hospital and also a Clinical Assistant Professor of Urology at The Ohio State University College of Medicine. Named to the list of "Best Doctors in America" in 2008, Dr. Jayanthi is a full-time pediatric urologist interested in all aspects of the medical and surgical management of genitourinary problems including such diverse conditions as urinary tract infections, hydronephrosis, urinary incontinence, hypospadias and intersex conditions. He also is interested in all aspects of genitourinary reconstructive surgery for both congenital and acquired conditions. He directs the Pediatric Urologic Laparoscopy Program at Nationwide Children's Hospital.

Stephen A. Koff, MD, is a member of the Section of Pediatric Urology at Nationwide Children's Hospital and Professor of Urology at The Ohio State University College of Medicine. Named to the list of "Best Doctors in America" in 2008, Dr. Koff received his medical degree from Duke University, followed by internship and residency at the New York Hospital/Cornell Medical Center and the University of Michigan and a fellowship at Alder Hey Children's Hospital. His research interests include the pre- and post-natal management of fetal hydronephrosis, the relationships between dysfunctional elimination, vesicoureteral reflux and urinary tract infection, the mechanisms for continuing obstructive uropathy in children with posterior urethral valves and neurogenic bladder, and reconstructive urology of the bladder, external genitalia and continent diversion.

MAKE A REFERRAL

- Fax referrals to (614) 722-4000.
- Schedule appointments by phone at (614) 722-6200.
- Schedule online at **www.NationwideChildrens.org**. (Click "Request an Appointment.")

For urgent physician consultations, call Nationwide Children's Physician Direct Connect line at (614) 355-0221 or 1-877-355-0221.

Learn more about our program and access helpful topics and publications at **www.NationwideChildrens.org** (keyword: Urology)

surgery**essentials**

PARTNERING FOR SUCCESSFUL OUTCOMES

At Nationwide Children's, we understand and respect the needs of physicians and know that the well-being of your patients is your number one concern. No health care professional takes the subject of surgical intervention lightly. That's why we believe in developing a partnership with our referring physicians to support the care you provide for your patients and families before, during and after surgery.

Visit NationwideChildrens.org/Surgery for CME offerings, practice tools, patient and family resources.

PRACTICE TOOL

Evaluating Pediatric Patients with Urinary Tract Infections

Urinary tract infections in children can range from symptomatic febrile episodes to seemingly asymptomatic UTIs which can prove to be the first *diagnosed* instance of multiple episodes of pyelonephritis. The Section of Pediatric Urology at Nationwide Children's Hospital can assist primary care physicians by differentiating the types of conditions and establishing a course of treatment.

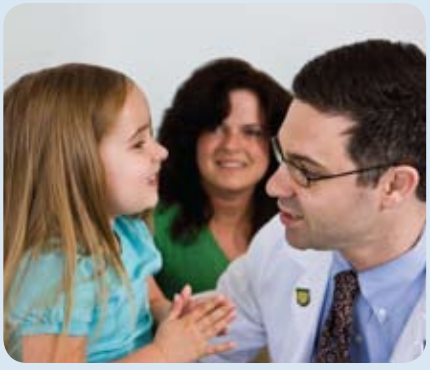
DIAGNOSIS MUST BE MADE BY URINE CULTURE.

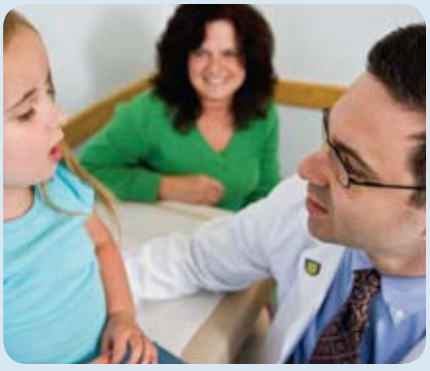
Evaluation of UTIs in children includes:

- Solid documentation of the UTI: Although many find urine dipstick tests with elevated leukocyte esterase and nitrates helpful in indicating probable clinically significant amounts of white cells and bacteria, diagnosis *must* be made by urine culture.
  - In infants and young children, the AAP recommends suprapubic aspiration or urethral catheterization.
  - In older children and adolescents, a clean-catch specimen is sufficient.
- Consideration of the age and gender of the patient
- Documentation of fever
- Careful voiding and bowel habit history. This evaluation should include:
  - Any history of UTIs—and whether any were febrile
  - Constipation or infrequent bowel movements
  - Abdominal or flank pain
  - Associated nausea and/or vomiting
  - Irritative symptoms:
    - Urgency
    - Dysuria
    - Frequency

A "RENAL" ULTRASOUND SHOULD ALWAYS INCLUDE THE BLADDER (PREFERABLY BOTH FULL AND EMPTY).

Since upper tract infection, particularly repeated pyelonephritis and the associated inflammation, can potentially lead to renal injury, and from there to possible renal scarring, hypertension and end-stage renal disease, complete evaluation to rule out conditions which would predispose patients to upper tract infection is appropriate for certain groups. Based on culture-documented UTIs, the patient's age, gender and presence or absence of suspicious symptoms such as high fever or flank pain, radiographic testing which may include renal ultrasound, cystogram and/or nuclear medicine renal scan may be appropriate for evaluation.





Diagnosis and Further Evaluation of Pediatric Urinary Tract Infections

DIAGNOSIS OF UTI IN URINE CULTURE

- >100,000 colonies of a single organism in a voided specimen is the most practical cutoff.
- 10,000 colonies of a single organism in catheter or suprapubic specimen
- < 10,000 colonies or multiple organisms suggests contamination
- Bagged urine culture is only helpful if negative and should always be validated with a catheterized specimen if positive.

FURTHER EVALUATION AND TIMING

- It is safe and appropriate to get a Renal Ultrasound (RUS) while the UTI is being treated. This should also image the bladder, both full and empty.
    - Note that patients with active UTI can have urinary stasis and/or transient hydronephrosis secondary to inflammation.
- Patients with febrile UTI may benefit from prophylactic antibiotics until the radiographic evaluation is completed.
- VCUG: Used to assess for bladder emptying, ureteral reflux or urethral obstruction. In the case of a UTI, ordering voiding cystourethography should wait until the child is no longer symptomatic and urine culture is negative.
    - A fluoroscopic VCUG should be used for the initial study for anatomic detail and urethral anatomy. Subsequently, a nuclear VCUG is sufficient for follow-up of ureteral reflux.
    - If reflux is suspected, a VCUG is the recommended study for evaluation.

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PRACTICE TOOL

Treatment of Urinary Tract Infections in Children

Cystitis: 3-7 days of antibiotics

- Trimethoprim sulfamethoxazole (TMP-SMX), nitrofurantoin, cephalosporin
- Possible follow-up culture after 2 weeks
- Antibiotic prophylaxis if vesicourethral reflux (VUR) is present or if there have been frequent recurrences
- Manage voiding dysfunction with timed and/or double-voiding and constipation with laxatives if present

Pyelonephritis: 10-14 days of antibiotics

- Some can be treated as outpatients.
  - Recommended: 1-2 days of **IM third generation cephalosporin**
  - **Then 10**-14 days oral antibiotics
- Initial hospitalization if:
  - Less than 2 months old
  - Toxic-appearing infant or child
  - Unable to tolerate oral meds
  - Questionable compliance
- Oral antibiotics once afebrile for 24-48 hours

ORAL ANTIMICROBIAL DRUGS FOR PEDIATRIC URINARY TRACT INFECTION

Drug	Daily dosage (mg/kg/d)	Frequency
Penicillin		
Ampicillin	50-100	q 6 h
Amoxicillin	20-40	q 8 h
Augmentin	20-40	q 8 h
Sulfonamide		
Trimethoprim-sulfamethoxazole	8[a]	q 12 h
Cephalosporin		
Cephalexin	25-50	q 6 h
Cefaclor	20	q 8 h
Cefixime	8	q 12-24 h
Cefadroxil	30[a]	q 12-24 h
Fluoroquinolone		
Ciprofloxacin	20-40[a]	q 12 h
Nalidixic acid	55 mg/kg/day	q 6 h
Other		
Nitrofurantoin	5-7	q 6 h

[a] Dose adjustment required with azotemia.

PARENTERAL ANTIMICROBIAL DRUGS FOR PEDIATRIC URINARY TRACT INFECTION

Drug	Daily dosage (mg/kg/d)	Frequency
Aminoglycoside		
Gentamicin	7.5[a]	q 8 h
Tobramycin	7.5[a]	q 8 h
Penicillin		
Ampicillin	50-100	q 6 h
Ticarcillin	50-200	q 4-8 h
Cephalosporin		
Cefazolin	25-50[a]	q 6-8 h
Cefotaxime	50-180[a]	q 4-6 h
Ceftriaxone	50-75	q 12-24 h
Cetriazidime	90-150[a]	q 8-12 h
Cefepime	100	q 12 h
Fluoroquinolone		
Ciprofloxacin	18-30[a]	q 8 h

[a] Dose adjustment required with azotemia.

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