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Urinary Tract Infections- Review Article

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ABSTRACT:

INTRODUCTION

Urinary tract infections (UTI) are a common bacterial infection in infants and children. The risk of developing UTI before the age of 14 years is approximately 1% in boys and 3-5% in girls(1). The incidence varies with age. During the first year of life, the male to female ratio is 3-5:1. Beyond 1-2 years, there is female preponderance with male to female ratio of 1:10. The diagnosis of UTI is often clinically missed in young children, as symptoms are minimal and often non-specific. Rapid evaluation and treatment of UTI is important to prevent renal parenchymal damage (renal scarring) that can cause hypertension and chronic renal failure later. Risk factors for renal scarring include; young age especially children less than one year old; delay in initiating antibacterial treatment; recurrences of UTI; and presence of moderate to serve vesicoureteric reflux (VUR) (1)

Definitions

Infection of the urinary tract is identified by growth of a significant number of organisms of a single species in the urine, in the presence of symptoms.

All febrile UTI are considered to involve the upper urinary tract with potential for renal scarring. An exception may be made in case of adolescent girls who present with symptoms restricted to the lower urinary tract.

Presenting Symptoms

UTI should be suspected in an infant or child presenting with unexplained fever beyond three days(2). In Neonates, UTI is usually a part of septicemia and presents with fever, vomiting, lethargy, jaundice and seizures. Infants and young children may present with recurrent fever, diarrhea, vomiting, abdominal pain and poor weight gain. Older children may have burning, urgency, frequency, flank pain, turbid or foul smelling urine or a recent onset of enuresis. The risk of UTI is higher in children with protein energy malnutrition and chronic diarrhea.

Diagnosis

The diagnosis of UTI is based on culture of a properly collected specimen of urine. Urinalysis is helpful in providing immediate information to suspect UTI and enable initiation of treatment. Confirmation of the diagnosis on urine culture is necessary.

TABLE I- *Definitions*

Significant bacteriuria	Colony count of > 10^5 /ml of a single species in a midstream clean catch sample
Asymptomatic bacteriuria	Presence of significant bacteriuria on two or more specimen in a child with no symptoms.
Recurrent UTI	Second attack of UTI
Complicated UTI	Presence of fever >38.5^{0}C, Toxicity, persistent vomiting, dehydration and renal angle tenderness.
Simple UTI	UTI with low grade fever, dysuria, frequency, urgency but none of the above symptoms.

TABLE II- *Interpretation of Urine Culture*

Method of collection	Colony Count	Probability of Infection (%)
Suprapubic aspiration	Urinary pathogen in any number	99
Urethral atheterization	>50x10^3CFU/ml	95
Midstream clean catch	>10^5 CFU/ml	90-95

Urinalysis

A careful urinalysis, on a fresh urine sample, can identify children with high likelihood of a UTI to enable presumptive treatment while awaiting results of urine culture (3). Several rapid screening tests are commonly used. Urinalysis may show mild proteinuria, leukocytouria (>5 leukocytes/high power field in a centrifuged sample or >10 leukocytes/mm3 in an uncentrifuged sample), bacteria on Gram stain and positive leukocyte esterase and nitrite test by dipstick.

Initial evaluation

Once UTI is suspected, the patient is examined for complications and the risk of recurrence. In an infant and young child the degree of toxicity, dehydration and ability to retain oral intake is assessed. The blood pressure should be recorded and history

regarding bowel and bladder habits elicited. Straining during micturition dribbling, poor urinary stream and ballooning of the prepuce suggest obstruction. The abdomen is palpated for renal lumps and the genitalia examined for phimosis. Tight prepuce or fused labia. Diurnal incontinence, urgency, frequency and constipation or encopresis may be associated. In such children, examination of perineal sensation, deep tendon reflexes in the lower extremities and inspection of the lower back for sacral dimpling or other abnormilities is useful. rectal examination should be done in patients with severe constipation.

Blood levels of urea and creatinine are estimated. Total and differential white cell count and blood culture is obtained in children with complicated UTI. Ultrasound examination of the abdomen is not required immediately unless there is clinical evidence of urinary tract obstruction or response to treatment is slower than anticipated.

Treatment

Children with complicated UTI and infants less than 3 months of age are treated with parenteral antibiotics. A combination of ampicillin and gentamicin, or a third generation cephalosporin (cefotaxime or ceftriaxone) is preferred. Gentamicin may be administered as a single medication in infants older than 3-6 months age. Once the child shows clinical improvement, with resolution of fever and toxicity, antibiotics may be administered orally. Young infants (<3 months old) and children with a positive blood culture should receive parenteral antibiotics for the entire duration of treatment.

Oral medications are used in children above three months of age with a simple UTI Amoxicillin, cotrimoxazole or an oral cephalosporin is preferred. Quinolones should be avoided as first line medication; their use is guided by results of urine sensitivity. Nalidixic acid or nitrofurantoin should not be used to treat UTI since they do not achieve therapeutic concentration in the renal parenchyma and blood stream. An abdominal ultrasound examination and repeat urine culture are necessary in patients who fail to show clinical response (reduction of fever and toxicity) within 48 h or initiation of treatment.

Duration of Treatment

The usual duration of therapy is 10-14 days for infants and children with complicated UTI, and 7-10 days for simple infections (2). Shorter duration treatment regimens are not recommended in children. Following the treatment of the UTI, prophylactic antibiotic therapy is initiated, in children below 2 years of age, until appropriate imaging of the urinary tract is completed.

Supportive Therapy

During an episode of an acute UTI, it is important to maintain adequate hydration. Alkalization of the urine is not necessary. Antipyretics are used to relieve fever.

TABLE III- *Antimicrobials for Treatment of UTI*

Parenteral			Oral		
Medication	mg/kg/day	Doses/day	Medication	mg/kg/day	Doses/day
Ampicillin	100	3	Amoxicillin	30-35	3
Gentamicin	5-6	2	Cotriomoxazole	6-10 (trimethoprim)	2
Amikacin	15-20	2	Cephalexin	50-70	3
Cefotaxime	100-150	3	Co-amoxi-clav	30-35 (amoxicillin)	2-3
Ceftriaxone	75-100	1-2	Cefaclor	40	3
			Ciprofloxacin	10-20	2
			Cefixime	8-10	2

TABLE IV- *Antimicrobials for Prophylaxis of UTI*

Drug	mg/kg/day	Remark
Cotrimoxazole	1-2 (trimethoprim)	Avoid in infants<3 months age.
Nitrofurantoin	1-2	Gastrointestinal upset; avoid in infants <3 months age, G-6 PD deficiency and renal Insufficiency.
Cephalexin	10	Drug of choice in first 3-6 months of life.

Subsequent Evaluation

The aim of these investigations is to identify patients at risk of renal damage, mainly those below 5 years of age, with VUR or urinary tract obstruction.

First Episode

Below the age of 2 years, an ultrasound and micturating cystourethrogram (MCU) are recommended. These investigations will detect most cases of reflux nephropathy or those 'at risk' in this age. Urinary tract ultrasonography will identify hydronephrosis, ureterocele and post-void residual ruine. Ultrasonography should be performed within 2-4 weeks following the UTI.

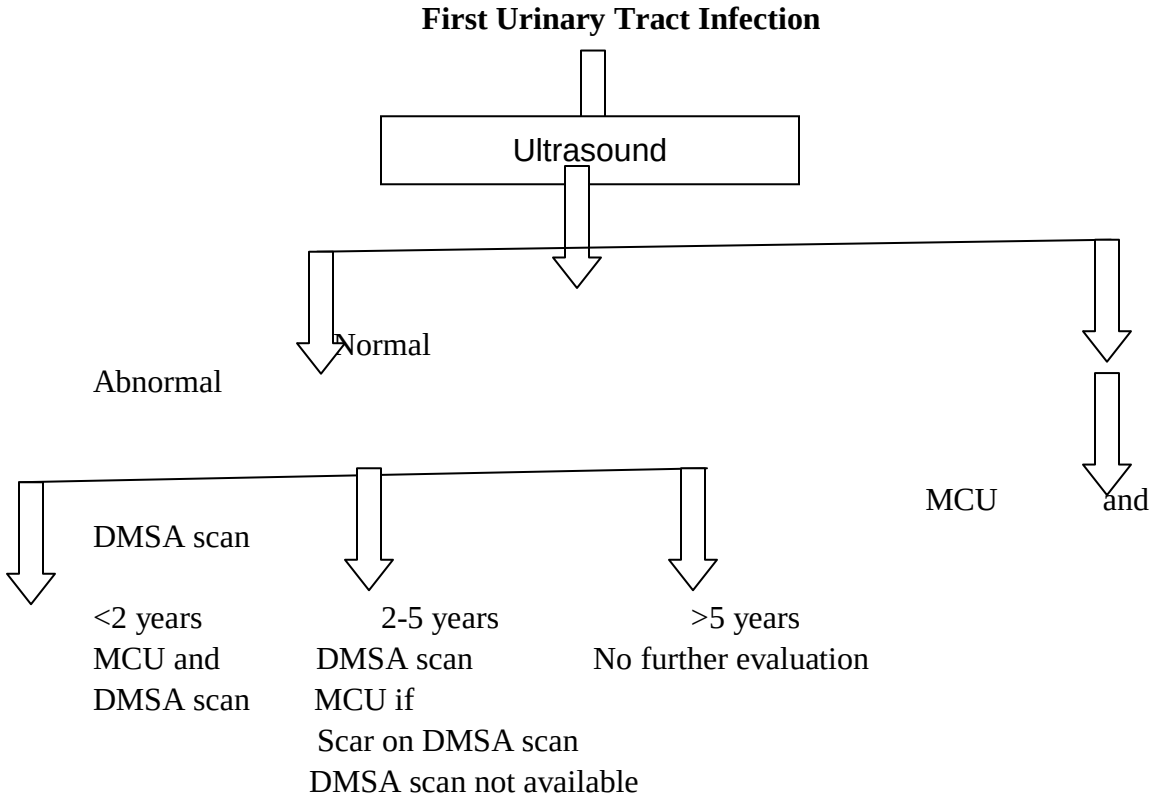
The MCU is useful for the diagnosis and grading of VUR, and detection of posterior urethral valves, ureterocele and bladder or urethral diverticuli. MCU is usually performed 4-8 weeks after treatment of the UTI.

Between the ages of 2-5 years, MCU is not immediately required, unless the symptoms suggest an underlying obstruction. An ultrasound and a DMSA (or GHA) renal scan done, and MCU performed only if either of the former investigations is abnormal. Children over the age of 5 years can be reliably screened with ultrasonography. Performed by an expert. Imagine with MCU and renal scan are necessary only if abnormalities are found on ultrasound examination.

The presence of VUR can also be demonstrated on direct radionuclide cystography (DRCG). However, grading of reflux using this method I not reliable. DRCG dose not evaluate the morphology of the urethra and bladder, and is thus not useful for establishing a diagnosis of posterior urethral valve or other anomalies.

Recurrent UTI

Children with more than one episode of UTI, irrespective of age, are evaluate with ultrasound and MCU. A renal cortical scan (DMSA or GHA) to detect Scars is recommended.



Additional Investigations

An X-ray of the spine may be done to look for spinal dysraphism if clinically suspected. An X-ray film of the kidney and urinary bladder region may show radiopaque renal or vesical calculi. The importance of intravenous pyelography (IVP) has declined following the availability of radioisotope scan. However, an IVP may be performed to examine for renal scaring if facilities for renal scintigraphy are not available. Cystoscopy is almost never required for evaluation of patients with UTI.

Antibiotic Prophylaxis

Long-term, low dose, antibacterial prophylaxis is used to prevent recurrent febrile UTI. The ideal antibiotic used should be effective, non-toxic with few side effects and not alter the indigenous bacterial flora or induce development of bacterial resistance. Medications used for prophylaxis are given as a single bedtime dose.

Indications and Duration of prophylaxis

Antibiotic prophylaxis is recommended under the following circumstances;

1. Following treatment of: (i) the first UTI in all children below 2 years of age, and (ii) complicated UTI in children below 5 years old, while awaiting imaging studies,
2. Children with VUR.
3. Patients showing renal scars following a UTI even if reflux is not demonstrated. Prophylaxis may be stopped if a radionuclide cystogram or MCU repeated 6 months later is normal.
4. Children with frequent febrile UTI (3 or more episode in a year) even if the urinary tract is normal.

The indication and duration of prophylaxis depends on the age of the child, presence of VUR and/or a renal scar on evaluation. Antibiotic prophylaxis is not recommended in patients with urinary tract obstruction (e.g., posterior urethral valves), urolithiasis or neurogenic bladder. Under these circumstances, prophylaxis can increase the chance of colonization with resistant organisms.

Measures to Reduce Recurrent UTI

Circumcision is not recommended routinely but may be considered for infants with recurrent UTI. Attention to undergarments and perineal hygiene, including the foreskin in boys, is explained to the parents. plenty of fluid intake and frequent voiding ensuresflushing out of the uropathogens. Constipation predisposes to recurrent UTI and improvement in bowel habits reduces the incidence of UTI. In children with VUR who are toilet trained, regular and volitional low pressure voiding with complete bladder emptying is encouraged. Double voiding is recommended in order to empty the bladder of post-void residual urine.

Breakthrough UTI on prophylactic Antibodies

Recurrences can occur due to infections cause by bacteria that are resistant to the antibiotic used for prophylaxis, or by sensitive bacteria (due to poor compliance, inadequate or infrequent dosing). Poor bladder emptying also predisposes to breakthrough infections. Breakthrough UTI should be treated with appropriate

antibiotics. Change of the medication being used for prophylaxis is not usually required. There is no role for cyclic theraphy, where the antibiotic used for prophylaxis is changed every 6-8 weeks. Patients having recurrent breakthrough infections may benefit from double prophylaxis with cotrimoxazole and nitrofurantoin.

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