

URINARY TRACT INFECTION

Introduction

Urinary tract infection (UTI) comprises 5% of febrile illnesses in early childhood. 2.1% of girls and 2.2% of boys will have had a UTI before the age of 2 years. UTI is an important risk factor for the development of hypertension, renal failure and end stage renal disease.

Definition

- *urinary tract infection* is growth of bacteria in the urinary tract or combination of clinical features and presence of bacteria in the urine
- *significant bacteriuria* is defined as the presence of > 10⁵ colony forming units (cfu) of a single organism per ml of freshly voided urine (Kass)
- *acute pyelonephritis* is bacteriuria presenting clinically with fever > 38°C and/or loin pain and tenderness. It carries a higher risk of renal scarring
- *acute cystitis* is infection limited to the lower urinary tract presenting clinically with acute voiding symptoms: dysuria, urgency, frequency, suprapubic pain or incontinence
- *asymptomatic bacteriuria* is presence of bacteriuria in the urine in an otherwise asymptomatic child

Clinical Presentation

Symptoms depend on the age of the child and the site of infection.

In infants and toddlers: signs and symptoms are non-specific e.g. fever, irritability, jaundice and failure to thrive. The presence of UTI should be considered in children with unexplained fever. Symptoms of lower UTI such as pain with micturition and frequency are often not recognized before the age of two.

Physical Examination

- general examination, growth, blood pressure
- abdominal examination for distended bladder, ballotable kidneys, other masses, genitalia, and anal tone
- examine the back for any spinal lesion
- look for lower limb deformities or wasting (suggests a neurogenic bladder)

Diagnosis

Accurate diagnosis is extremely important as false diagnosis of UTI would lead to unnecessary interventions that are costly and potentially harmful.

The quality of the urine sample is of crucial importance (see table 1).

Urine specimen transport

If collected urine cannot be cultured within 4 hours; the specimen should be refrigerated at 4°C or a bacteriostatic agent e.g. boric acid (1.8%) added. Fill the specimen container pre-filled with boric acid with urine to the required level.

Urine testing

Rapid diagnosis of UTI can be made by examining the fresh urine with urinary dipstick and microscopy. However, where possible, a fresh specimen of urine should be sent for culture and sensitivity.

Table 1. Collection of urine

Bag urine specimen
- high contamination rate of up to 70%
- negative culture excludes UTI in untreated children
- positive culture should be confirmed with a clean catch or suprapubic aspiration specimen (SPA)
Clean catch specimen
- recommended in a child who is bladder trained
Catheterisation
- sensitivity 95%, specificity 99%, as compared to SPA
- low risk of introducing infection.
Suprapubic aspiration (SPA)
- the best technique ("gold standard") of obtaining an uncontaminated urine sample
- any gram negative growth is significant.
- technique:
lie the child in a supine position
thin needle with syringe is inserted vertically in the midline, 1 - 2 cm above symphysis pubis.
urine is obtained at a depth of 2 to 3 cm
usually done in infants < 1 year; also applicable in children aged 4 - 5 years if bladder is palpable above the symphysis pubis.
success rate is 98% with ultrasound guidance.
<i>Note: When it is not possible to collect urine by non-invasive methods, catheterization or SPA should be used.</i>

Management

All infants with febrile UTI should be admitted and intravenous antibiotics started as for acute pyelonephritis. In patients with high risk of serious illness, it is preferable that urine sample should be obtained first; however treatment should be started if urine sample is unobtainable.

Antibiotic prophylaxis

Previous guidelines have recommended routine antibiotic prophylaxis for all children below 5 years of age prior to radiological imaging. However recent evidence has not supported this practice. Hence, antibiotic prophylaxis may be considered in the following:

- infants and children with recurrent symptomatic UTI
- infants and children with vesico-ureteric reflux grades of at least grade III

Measures to reduce risk of further infections

- **Dysfunctional elimination syndrome (DES)** or dysfunctional voiding is defined as an abnormal pattern of voiding of unknown aetiology characterised by faecal and/or urinary incontinence and withholding of both urine and faeces. treatment of DES includes high fibre diet, use of laxatives, timed frequent voiding, and regular bowel movement. if condition persists, referral to a paediatric urologist/nephrologist is needed.

Table 2. Sensitivity and specificity of various tests for UTI

test	sensitivity % (range)	specificity % (range)
leucocyte esterase (LE)	78 (64-92)	83 (67-94)
nitrite	98 (90-100)	53(15-82)
LE or nitrite positive	72 (58-91)	93 (90-100)
pyuria	81 (45-98)	73 (32-100)
bacteria	83 (11-100)	81(16-99)
any positive test	70 (60-90)	99.8 (99-100)

Note: The presence of bacteria, positive nitrite ± positive leucocyte esterase is suggestive of UTI and antibiotic should be started after sending a urine sample for culture.

Table 3. Antibiotic treatment of UTI

Type of Infection	Preferred Treatment	Alternative Treatment
UTI (Acute cystitis) - <i>E.coli.</i> - <i>Proteus spp</i>	PO Trimethoprim 4mg/kg/dose bd (max 300mg daily) for 1 week	PO Trimethoprim/sulphamethazole 4mg/kg/dose (TMP) bd x1 week
Note: - cephalexin, cefuroxime can also be used especially in children who had prior antibiotics. - single dose of antibiotic therapy not recommended.		
Upper UTI (Acute pyelonephritis) - <i>E.coli.</i> - <i>Proteus spp</i>	IV cefotaxime 100mg/kg/day q8h for 10-14 days	IV cefuroxime 100mg/kg/d q8h or IV Gentamicin 5-7mg/kg/day daily
Note: - repeat culture within 48hours if poor response - antibiotic may need to be changed according to sensitivity.		
Asymptomatic bacteriuria No treatment recommended		

Table 4. Antibiotic prophylaxis for UTI

Indication	Preferred Treatment	Alternative Treatment
UTI prophylaxis	PO Trimethoprim 1-2mg/kg ON	Nitrofurantoin 1-2mg/kg ON or Cephalexin 5mg/kg ON
Note: - antibiotic prophylaxis should not be routinely recommended in children with UTI. - prophylactic antibiotics should be given for 3 days with MCUG done on the second day - if a child develops an infection while on prophylactic medication, treatment should be with a different antibiotic and not a higher dose of the same prophylactic antibiotic.		

Recommendations for imaging

Previous guidelines have recommended routine radiological imaging for all children with UTI. Current evidence has narrowed the indications for imaging as summarized below:

Ultrasound

Recommended in

- all children less than 3 years of age
- children above 3 years of age with poor urinary stream, seriously ill with UTI, palpable abdominal masses, raised serum creatinine, non E coli UTI, febrile after 48 hours of antibiotic treatment, or recurrent UTI

DMSA scan

Recommended in infants and children with UTI with any of the following features:

- seriously ill with UTI
- poor urine flow
- abdominal or bladder mass
- raised creatinine
- septicaemia
- failure to respond to treatment with suitable antibiotics within 48 hours
- infection with non-E. coli organisms

Micturating cystourethrogram (MCUG)

Should be considered in:

- infants with recurrent UTI
- infants with UTI and the following features: poor urinary stream, seriously ill with UTI, palpable abdominal masses, raised serum creatinine, non E coli UTI, febrile after 48 hours of antibiotic treatment
- children less than 3 years old with the following features:
 - dilatation on ultrasound
 - poor urine flow
 - non E coli infection
 - family history of VUR

Other radiological investigations e.g. DTPA scan, MCUG in older children would depend on the ultrasound findings.

Further Management

This depends upon the results of investigation.

Normal renal tracts

- prophylactic antibiotic not required.
- urine culture during any febrile illness or if the child is unwell.

No VUR but renal scarring present.

- repeat urine culture only if symptomatic.
- assessment includes height, weight, blood pressure and routine tests for proteinuria
- children with a minor, unilateral renal scarring do not need long-term follow-up unless recurrent UTI or family history or lifestyle risk factors for hypertension
- children with bilateral renal abnormalities, impaired renal function, raised blood pressure and or proteinuria should be managed by a nephrologist.
- close follow up during pregnancy

Vesicoureteric reflux

Definition

Vesicoureteral reflux (VUR) is defined as the retrograde flow of urine from the bladder into the ureter and collecting system. In most individuals VUR results from a congenital anomaly of ureterovesical junction (primary VUR), whereas in others it results from high pressure voiding secondary to posterior urethral valve, neuropathic bladder or voiding dysfunction (secondary VUR).

Significance of VUR

- commonest radiological abnormality in children with UTI (30 – 40%).
- children with VUR thought to be at risk for further episodes of pyelonephritis with potential for increasing renal scarring and renal impairment

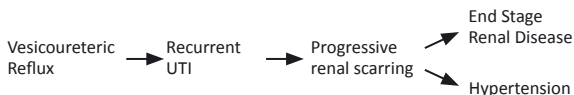
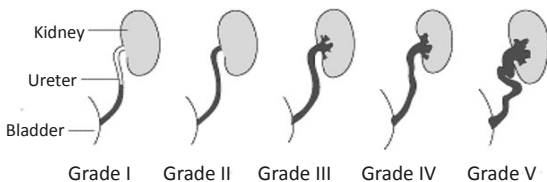


Figure 2. Natural history of vesicoureteric reflux

Classification of VUR according to the International Reflux Study Committee.



Management

Antibiotic prophylaxis – refer to antibiotic prophylaxis section above

Surgical management is considered if the child has recurrent breakthrough febrile UTI

Posterior urethral valve

refer to paediatric urologist/surgeon/nephrologist.

Renal dysplasia, hypoplasia or moderate to severe hydronephrosis

- may need further imaging to evaluate function or drainage in the case of hydronephrosis
- refer surgeon if obstruction is confirmed.
- monitor renal function, BP and growth parameters

Summary

- all children less than 2 years of age with unexplained fever should have urine tested for UTI.
- greater emphasis on earlier diagnosis & prompt treatment of UTI
- diagnosis of UTI should be unequivocally established before a child is subjected to invasive & expensive radiological studies