



# Urinary tract infection



- UTI are the most common genitourinary disease of childhood.
- The prevalence of UTI at all ages is :
  - ❑ 1-3% of girls
  - ❑ 1% of boys.
- Below 1 year  $\approx$  male: female 4:1, especially among uncircumcised males
- but after 1 year male: female ratio is 1:10.

# Etiology:

- UTI is mainly caused by colonic bacteria e.g. *E coli*, followed by *Klebsiella* and *Proteus*. Infrequently it caused by *Staphylococcus saprophyticus* and *enterococcus* as well as to viral infection e.g. adenovirus



# Pathology

- Virtually all UTIs are **ascending infections**. The bacteria arise from the fecal flora and enter the bladder via urethra.
- Rarely, in some neonates, renal infection may occur by hematogenous spread.

# Risk factors:

1	Female gender	2	Uncircumcised male
3	Vesicoureteral reflux	4	Voiding dysfunction
5	Obstructive uropathy	6	Neuropathic bladder
7	Urethral instrumentation	8	Constipation
9	Bacteria with P fimbriae	10	Pinworm infestation
11	Tight clothing	12	Toilet training
13	Anatomic abnormality (labial adhesion)	14	Wiping from back to front in females
15	Bubble bath	16	Sexual activity & Pregnancy.

# Clinical manifestations:

- The symptoms and signs of UTI vary with age:
- **Neonate:** commonly presents with
  - FTT
  - feeding problem
  - diarrhea, vomiting
  - Fever
  - hyperbilirubinemia



# Clinical manifestations:

- 1month-2 year infant
- usually has non urinary tract manifestations
- FTT
- feeding problems
- diarrhea
- unexplained fever
- gastrointestinal illness
- such as colic, irritability, screaming periods.



# Clinical manifestations:

- 2-6 years old child may have GIT symptoms and classic signs of UTI such as urgency, dysuria, frequency abdominal pain.
- 6-18years old most commonly:
  - will have urgency,
  - frequency,
  - abdominal or flank pain.





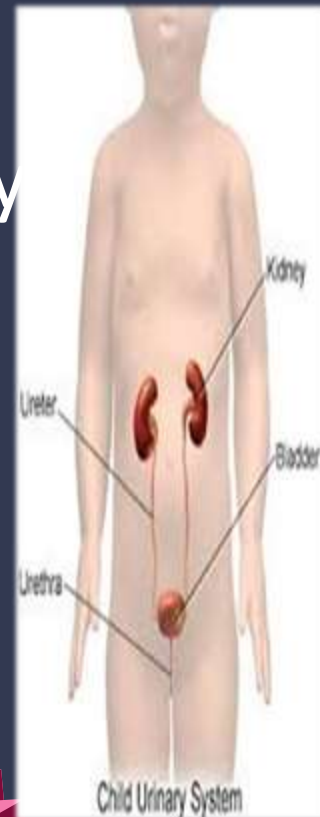


# There are 3 main types of UTI

- 1. Asymptomatic Bacteriuria
- refers to a condition that results in a **positive urine culture** without any manifestations of infection. It is most common in girls.

**2. Cystitis** (infection of bladder lower UTI) → dysuria, urgency, frequency, suprapubic pain, incontinence, and malodorous urine. It **does not** cause fever or renal injury

**3. Pyelonephritis** (upper UTI) is clinically manifested as abdominal or flank pain, fever, malaise, nausea, vomiting, and occasionally diarrhea.



# Complications:

- Chronic recurrent UTI → renal scarring which result in chronic hypertension & renal insufficiency.





# Investigations

- UTI may be suspected based on :
- symptoms
- urinalysis,
- urine culture
- Imaging studies



# Investigations

- Dx of UTI is generally depends on the symptoms, GUE, & urine culture.
- Methods for collection of urine sample:
  - In toilet-trained children:
  - a midstream urine sample usually is satisfactory; the area should be cleaned before obtaining the specimen.



# Investigations

## ➤ Children 2-24 months:

- a catheterized or suprapubic aspirate urine sample should be obtained.
- Alternatively, the application of an adhesive sealed, sterile urine bag after disinfection of the skin
- can be useful **only if the culture is negative or if a single uropathogen is identified.**
- However, a positive culture can result from skin contamination

# How to obtain a urine sample



Source: John Murtagh, Jill Rosenblatt: *John Murtagh's General Practice*, 6e:  
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- a. GUE: Freshly motile bacteria suggest UTI, microscopic hematuria is common in acute cystitis. WBC casts suggest renal involvement. Pyuria suggests infection, although it is more **confirmatory rather than diagnostic** because infection can occur without pyuria & vice-versa.





- Pyuria (leukocytes on urine microscopy) suggests infection, but infection can occur in the absence of pyuria; this finding is more confirmatory than diagnostic.
- Nitrites and leukocyte esterase usually are positive in infected urine.
- Microscopic hematuria is common in acute cystitis, but microhematuria alone does not suggest UTI



## Table 1. Urinalysis Results

Test	Usual Range	Indicators of Infection	Accuracy
Bacteria	Absent	Any amount	Low sensitivity, <sup>a</sup> high specificity <sup>b</sup>
Leukocyte esterase	Absent	Positive = pyuria, presence of WBCs in urine	High sensitivity, low specificity
WBC	<5	Pyuria: WBC >10	High sensitivity, low specificity
Nitrite	Absent	Positive = presence of bacteria that reduce nitrate	Low sensitivity, high specificity
RBC	<5	Hematuria common in infection	Low sensitivity, high specificity
Epithelial cells	<5	<5 = good urine sample	High epithelial cells indicate contamination with skin flora
pH	4.5-8	pH ↑ if urea-splitting organism (e.g., <i>Proteus mirabilis</i> ) is present	Low specificity (there are many other causes of alkaline urine)

<sup>a</sup> Sensitivity = likelihood of positive test when disease is present.

<sup>b</sup> Specificity = likelihood of negative test when disease is not present.

Source: Reference 1.

# Sterile pyuria (positive leukocytes, negative culture) may occur in:



1. partially treated bacterial UTIs
2. viral infections
3. renal tuberculosis
4. renal abscess
5. urinary obstruction
6. inflammation near the ureter or bladder eg. appendicitis

## B-Urine culture

- If the culture (suprapubic or catheter sample) shows **>50,000** colonies of a single pathogen regardless of symptoms, or if there are **10,000** colonies with symptoms, the child is considered to have a UTI.
- In (bag sample), if the urinalysis result is positive, the patient is symptomatic, and there is a single organism cultured with a colony count **>100.000** there is a presumed UTI
- **Note:** *Urine sample should be analyzed & cultured promptly because if left at room temperature for >1 hr, overgrowth of minor contaminant will suggest UTI when the urine actually may not. Refrigeration is a reliable method of storing the urine until it can be cultured.*

c-CBP in upper UTI, there is leukocytosis (neutrophilia),  
↑ ESR & CRP

d- blood cultures should be drawn before starting antibiotics if possible as sepsis is common in pyelonephritis, particularly in infants and any child with obstructive uropathy

e-Imaging studies are used to identify the anatomical abnormalities, these include:-

1. **Ultrasound of kidney** is indicated initially for all infants with UTI as well as children with +ve urine culture, febrile UTI, recurrent UTI, & UTI which associated with systemic disease to exclude obstruction and determine the size of the kidney, rule out hydronephrosis, renal abscess .
2. **VCUG** is indicated if the U/S study is abnormal, the patient has atypical features, or after a recurrent febrile UTI. is in 2 types; contrast or radionuclide (which can ↓ irradiation dose especially for girls). The timing of VCUG is controversial; some recommend it before discharge of patient from hospital, whereas others prefer delay for 2-6 wk (to allow inflammation in bladder to resolve to reduce the incidence of vesicoureteral reflux). However recent studies show that incidence of reflux is the same whether VCUG is done now or then.

- **3. IV pyelography** to evaluate kidney size , calyceal blunting , urethral dilatation.
- 4. Renal scanning using DMSA** (di-mercapto- succenic acid) is used to detect renal scars that usually develop after severe or recurrent upper UTI.
- 5. CT scan** can also detect renal scars



# Treatment:

- Patients with severe UTI should receive empirical antibiotics before the results of culture.
- Acute cystitis
- should be treated promptly to prevent progression to pyelonephritis, a 3-5 day course of
  - 1) trimethoprim-sulfamethoxazole (TMP-SMX) or trimethoprim is effective against many strains of
    - E. coli.
  - 2) Nitrofurantoin (5-7 mg/ kg/24 hr. in 3-4 divided doses) has the advantage of being active against Klebsiella and Enterobacter organisms.
  - 3) Amoxicillin (50 mg/kg/24 hr.) also is effective as initial treatment but has a high rate of bacterial resistance.





# Treatment:

- Acute pyelonephritis, a 7-14 day course of broad-spectrum antibiotics is preferable.
- ❖ Children should be admitted to the hospital for IV rehydration and IV antibiotic therapy :
  - i. dehydrated,
  - ii. vomiting,
  - iii. unable to drink fluids,
  - iv. 1 mo. of age or younger,
  - v. have complicated infection, or in whom urosepsis is a possibility.



# Treatment:

- Parenteral treatment with:

- 1) Ceftriaxone (50-75 mg/kg/24 hr., Not to exceed 2 g)
- 2) Cefotaxime (100 mg/kg/24 hr.),
- 3) Ampicillin (100 mg/ kg/24 hr.) With an aminoglycoside such as gentamicin (3-5 mg/kg/24 hr. in 1-3 divided doses) is preferable. Treatment with aminoglycosides is particularly effective against *Pseudomonas* spp .



# Treatment:

4. Oral third-generation cephalosporins such as cefixime are as effective as parenteral ceftriaxone against a variety of Gram-ve organisms other than Pseudomonas, and these medications are considered to be the treatment of choice for oral outpatient therapy.

5. Ciprofloxacin is an alternative agent for resistant microorganisms, particularly Pseudomonas, in patients older than age 17 yr.

- In some children with a febrile UTI, intramuscular injection of a loading dose of ceftriaxone followed by oral therapy with a third-generation cephalosporin is effective

- ❖ **Note:** A urine culture 1 wk. after the termination of treatment of a UTI ensures that the urine is sterile
- ❖ **Urologic conditions for recurrent UTIs that might benefit from long-term prophylaxis include :**
  - ✓ neuropathic bladder
  - ✓ urinary tract stasis and obstruction and urinary calculi.
  - ✓ severe vesicoureteral reflux In a child with recurrent UTIs.

- ❖ Antimicrobial prophylaxis using **trimethoprim or nitrofurantoin at 30% of the normal therapeutic dose once a day. TMP-SMZ, amoxicillin, or cephalexin can also be effective**
- ❖ ***Note: Alkalinization of urine by sodium bicarbonate increases the efficacy of aminoglycosides in the urinary tract. Nitrofurantoin should not be used in children with febrile UTI because it does not achieve significant renal tissue levels.***

- ❖ Children with **renal or perirenal abscess** or with infection in obstructed urinary tracts often require surgical or percutaneous **drainage** in addition to the antibiotic therapy.
- ❖ **Urine culture after 1 wk of Rx** may be required to ensure that the urine is sterile.

# Atypical UTI

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

# Recurrent UTI

- **two or more episodes of acute pyelonephritis**
- **Or one episode of acute pyelonephritis plus one or more episode of cystitis**
- **Or three or more episodes of cystitis**