

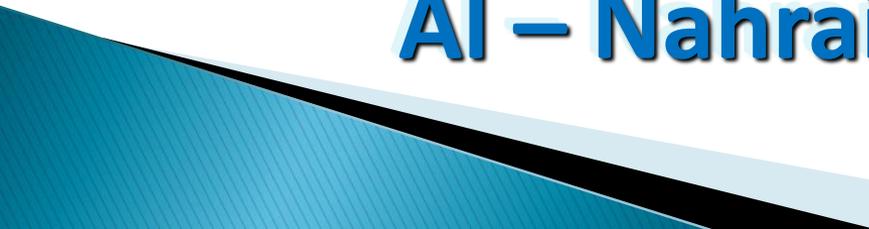
# **Urinary Tract Infection in Children**

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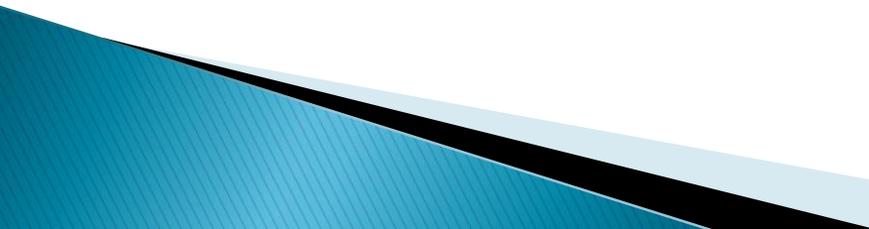




**College Of Medicine**  
Al-Nahrain University  
1987



# **OBJECTIVES**

- ▶ **Classification of UTI**
  - ▶ **Risk factors for UTI and renal scarring**
  - **Diagnosis of UTI**
  - **Common errors made in the diagnosis of UTI**
  - **Key elements of AAP guidelines on UTI in children 2-24 months old**
  - **Complications of UTI**
  - **Renal imaging after UTI**
  - **Antibiotic treatment of UTI**
  - **Role of antimicrobial prophylaxis**
- 

# DEFINITION

**bacterial  
growth  
within  
the  
urinary  
tract.**



# Incidence of UTI

- ▶ first year of life:
  - ▶ boys (3.7%) > girls (2%)
- ▶ During prepubertal age,
  - ▶ girls is 3%, as compared to 1% in boys.
- ▶ risk of UTI recurrence in the first 6 to 12 months after the initial UTI is ~12% to 30%.

# Prevalence of UTI in febrile children age 2–24 months

- Girls – 5%
- Uncircumcised boys – 2%
- Circumcised boys – 0.2%

# Bacteriology of UTI

\* *Escherichia. coli.* 80-90%

\* *Klebsiella*

\* *Proteus*

\* *Pseudomonas*

\* *Staph. aureus*

\* *Enterococcus*

\* *Enterobacter*

# Classification of UTI

- ▶ clinical presentation
  - ▶ site
  - ▶ severity of infection
  - ▶ frequency of UTI
  - ▶ Renal status :occurrence of renal scarring
- 

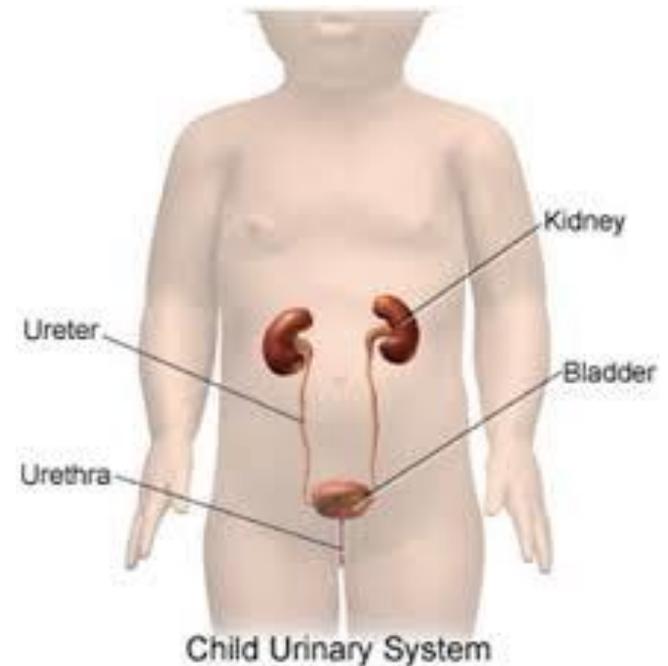
# Classification of UTI :

## Clinical presentation

- ▶ Febrile UTI : UTI with Temp  $\geq$  38°C (100.4°F)
- ▶ Symptomatic UTI : UTI associated with fever and/or urinary symptoms

# Classification of UTI : site

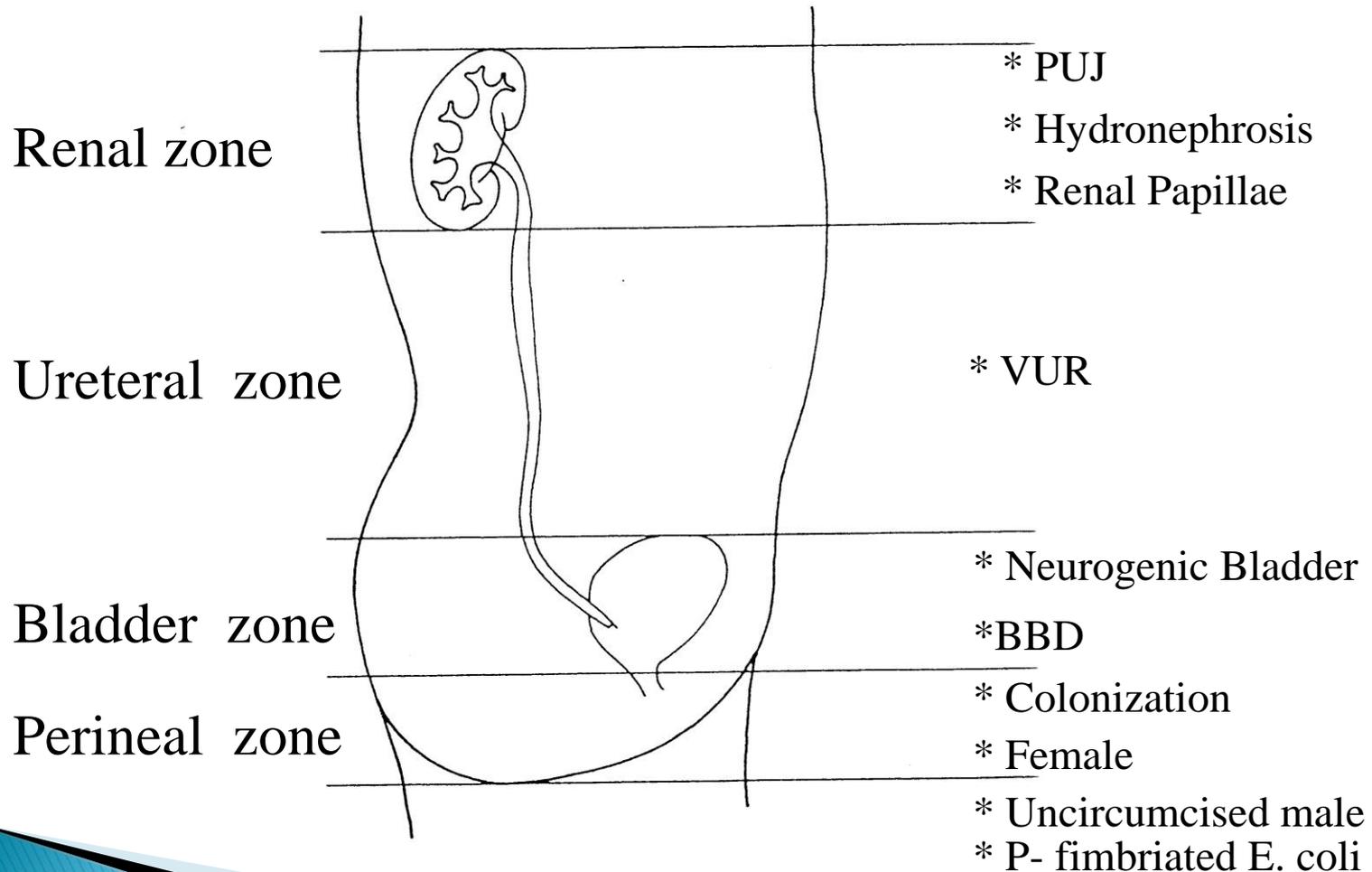
- ▶ Upper-tract UTI : kidneys and ureters
- ▶ Lower-tract UTI : bladder and urethra
- ▶ Pyelonephritis ( PN): Kidney infection
- ▶ febrile UTI may or may not be due to PN
- ▶ Cystitis : Bladder infection



# Classification of UTI : severity of infection

- ▶ **Complicated UTI :**
- ▶ UTI in newborns
- ▶ abdominal and/or bladder mass
- ▶ CAKUT
- ▶ urosepsis
- ▶ organism other than E coli
- ▶ atypical clinical course: absence of clinical response to antibiotic within 72 h
- ▶ renal abscess

# Urinary tract defense zones



# RISK FACTORS FOR UTI

the American Academy of Pediatrics (AAP) Clinical Practice Guideline for the Diagnosis And Management of the Initial UTI in Febrile Infants and Children 2 to 24 months of age / 2011



# RISK FACTORS FOR UTI

- A calculator was recently developed to help clinicians estimate the probability of UTI in febrile infants at the bedside (<https://uticalc.pitt.edu>)
- ▶ It is based on 5 risk factors :
- ▶ This prediction rule :
  - ✓ sensitivity of 88%
  - ✓ specificity of 30%



Use the American Academy of Pediatrics Urinary Tract Infection Guidelines table when assessing risk factors.  
 \*For uncircumcised febrile boys, probability of UTI exceeds 1% even with no risk factors other than being uncircumcised

| Individual Risk Factors: Girls   |
|--|
| White race<br>Age < 12 mo<br>Temperature $\geq 39^{\circ}\text{C}$<br>Fever $\geq 2$ d<br>Absence of another source of infection |

| Probability of UTI | No. of Factors Present |
|--------------------|------------------------|
| $\leq 1\%$         | No more than 1         |
| $\leq 2\%$         | No more than 2         |

| Individual Risk Factors: Boys  |
|--|
| Nonblack race<br>Temperature $\geq 39^{\circ}\text{C}$<br>Fever > 24 h<br>Absence of another source of infection |

| Probability of UTI | No. of Factors Present |                |
|--------------------|------------------------|----------------|
|                    | Uncircumcised          | Circumcised    |
| $\leq 1\%$         | a                      | No more than 2 |
| $\leq 2\%$         | None                   | No more than 3 |

# A calculator.....

- 1 the initial calculation leads to a recommendation for or against obtaining a urine sample.
  2. If urine is obtained, the results from urinalysis or urine dipstick are added to the calculator and the probability of a UTI is calculated.
  3. The calculator goes one step further and suggests or rejects the need for empiric treatment based on its overall estimate
- 

# RISK FACTORS FOR UTI

the precise threshold risk of UTI warranting obtaining a urine specimen is left to the clinician but is below 3%.

This **calculator** aids in the reduction of unnecessary catheterization or antibiotic use.



# DIAGNOSIS OF UTI

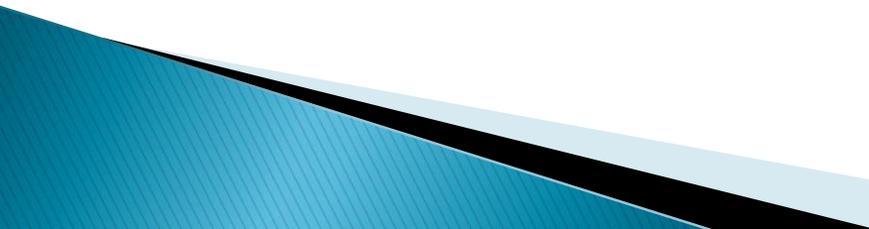
- ▶ The diagnosis of UTI in children is based on the results of urinalysis and urine culture
- ▶ Demonstration of both
  - inflammation in the urine (WBCs, leukocyte esterase)
  - bacteria growing in the culture

# Definition of UTI

- ▶ The 2011 American Academy of Pediatrics (AAP) guideline defines UTI by :
- ▶ the presence of at least 50 000 CFU/mL of a uropathogen in a specimen obtained by bladder catheterization in a child with either a positive result on a leukocyte esterase test or with white blood cells in the urine on microscopy (pyuria)

# DIAGNOSIS OF UTI

## AAP Guidelines in Febrile Infants and Children 2 to 24 Months

- Bladder catheterization or suprapubic collection for culture if UA collected by any other means is positive
  - Urinalysis and culture specimens before antimicrobial treatment is initiated.
  - Pyuria/bacteriuria and positive urine culture necessary for diagnosis of UTI
- 

# Diagnosis in Children Less Than 24 Months of Age

- ▶ **Urine Collection**
- ▶ Infants are generally not able to submit a clean-caught voided specimen;
- ▶ therefore, catheterization or suprapubic bladder aspiration is often performed to collect a urine sample for urinalysis and culture.
- ▶ Urine collection with a bag is also an option with special considerations, but the urine collected should be analyzed only for urinalysis and not culture.

# URINE BAG

- ▶ high false-positive culture result 88%
- ▶ A “positive” culture result cannot be used to document a UTI;
- ▶ confirmation requires culture of a specimen collected through catheterization or SPA
- ▶ are valid only when they yield negative results.

# URINE BAG

- ▶ Can reduce contamination rate under the following circumstances:
  - the patient's perineum is properly cleansed and rinsed before application of the collection bag,
  - The urine bag is removed promptly after urine is voided into the bag,
  - specimen is refrigerated or processed immediately.
- ▶ Even if contamination from the perineal skin is minimized,
- ▶ however, there may be significant contamination from the vagina in girls or the prepuce in uncircumcised boys

# CATHETERIZATION

Urine obtained through catheterization for culture has :

**sensitivity of 95%**

**specificity of 99%**

samples of urine obtained by catheterization may be contaminated by urethral flora.

- ▶ To avoid contamination, 2 practical steps:
  - (1) the first few milliliters obtained by catheter should be discarded
  - (2) if the attempt at catheterization is unsuccessful, a new, clean catheter should be used

When evaluating infants for UTI, the clinician can review with the family the advantages and disadvantages of urine collection through catheterization or with a bag, as reviewed

|                 | Advantages  | Disadvantages   |
|-----------------|---|---|
| Catheterization | <ul style="list-style-type: none"><li>- quick</li><li>- urine culture can be sent initially</li></ul> | <ul style="list-style-type: none"><li>- pain and discomfort</li></ul>   |
| Bag specimen    | -may avoid the pain and discomfort from catheterization if urinalysis is normal                       | <ul style="list-style-type: none"><li>- if urinalysis is abnormal (elevated WBC or leukocyte esterase) then would proceed to catheterization to confirm</li><li>- may take significant time for infant to void in bag</li></ul> |

# Suprapubic needle aspiration

- ▶ is also an option for obtaining urine specimens but is less commonly used because the procedure is more painful than catheterization the success rate 23 – 90 %
- ▶ Phimosis
- ▶ Labial adhesion
- ▶ Urethral stricture
- ▶ Urethral trauma

# OTHER METHODS

- ▶ In older, toilet-trained children: catching the midstream urine in a sterile cup
  - ▶ the Quick-Wee method of urine collection
  - ▶ the bladder stimulation technique
- 

# URINE DIPSTICK

is the most widely available screening test.

1. Nitrites test: a marker of some gram-negative bacteria

2. leukocyte esterase : a marker of WBCs.

The results are usually reported as (negative, trace, 1+ , 2+ , and 3+).

# Nitrite Test

- ▶ **Sensitivity 53% , Specificity 98%**
- ▶ urinary nitrite is converted from dietary nitrates by most Gram-negative bacteria to nitrites
- ▶ Conversion requires approximately 4 hours
- ▶ nitrite test is not a sensitive marker for infants, who empty their bladders frequently.
- ▶ A negative nitrite test results have little value in ruling out UTI.
- ▶ not all urinary pathogens reduce nitrate to nitrite.
- ▶ **The test is helpful when the result is positive**
- ▶ because it is highly specific (ie, there are few false-positive results)

# Leukocyte Esterase Test (LE)

- ▶ a surrogate marker for pyuria
- ▶ **The sensitivity is 83 %**
- ▶ **The specificity is 72%**
- ▶ **false-positive results are common.** numerous conditions other than UTI: streptococcal infections or Kawasaki disease, vigorous exercise,

# *Leukocyte Esterase Test (LE)*

- ▶ The absence of pyuria in children with
- ▶ true UTIs is rare, ?
- ▶ inflammatory response to a UTI produces
- ▶ both fever and pyuria

# Nitrite Test versus LE

Nitrite Test:      Low Sensitivity  
                         High Specificity

- ▶ few false-positive results

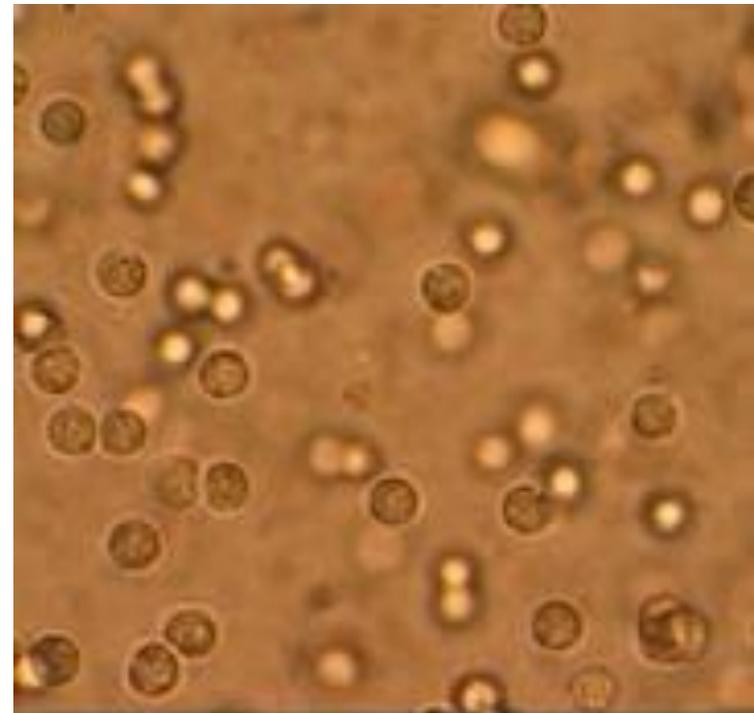
Leukocyte Esterase Test (LE)  
                         High Sensitivity  
                         Low Specificity

- ▶ false-positive results are common.



# Significant pyuria

- ✓ enhanced Uncentrifuged urinalysis:  
is  $\geq 10$  white blood cells/mm<sup>3</sup>
  - ✓ or centrifuged specimen of urine:  
 $\geq 5$  white blood cells per high power field
  - ✓ or any leukocyte esterase on a dipstick.
- 
- ▶ pyuria increases the
  - ▶ likelihood of UTI



# *Microscopic Analysis for Bacteriuria*

- ▶ The presence of bacteria in a fresh, Gram-stained specimen of uncentrifuged urine correlates with  $10^5$  CFUs per mL in culture

# Interpretation of the Urinalysis: urine dipstick and microscopic

| Test   | Sensitivity<br>(Range), % | Specificity<br>(Range), % |
|--|---------------------------|---------------------------|
| Leukocyte esterase test  | 83 (67–94)                | 78 (64–92)                |
| Nitrite test   | 53 (15–82)                | 98 (90–100)               |
| Leukocyte esterase or nitrite test positive                      | 93 (90–100)               | 72 (58–91)                |
| Microscopy, WBCs   | 73 (32–100)               | 81 (45–98)                |
| Microscopy, bacteria   | 81 (16–99)                | 83 (11–100)               |
| Leukocyte esterase test, nitrite test, or<br>microscopy positive | 99.8 (99–100)             | 70 (60–92)                |

# Interpretation of the Urine Culture Results

- ▶ The acceptable colony count threshold for a urine culture positive for UTI depends on
- ▶ its collection method
- ▶ catheterization : 50 000 colony-forming units (CFUs)/mL
- ▶ clean catch : 1 00 000 CFUs/mL
- ▶ suprapubic aspiration : 1 000 CFU/mL

# Definition of UTI

- ▶ The 2011 American Academy of Pediatrics (AAP) guideline defines UTI by :
- ▶ the presence of at least 50 000 CFU/mL of a uropathogen in a specimen obtained by bladder catheterization in a child with either a positive result on a leukocyte esterase test or with white blood cells in the urine on microscopy (pyuria)

# requiring pyuria for diagnosis has recently been questioned ?

- ▶ UTI with different organisms may be associated with different degrees of pyuria:
- ▶ Enterococcus species, Klebsiella, Pseudomonas can cause infection in the absence of Pyuria
- ▶ Also controversial is the use of a single colony count threshold for all children
- ▶ Several studies have revealed that some children with lower colony counts have true UTIs and even pyelonephritis

AAP 2011

CLINICAL PRACTICE GUIDELINE

# Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months

SUBCOMMITTEE ON URINARY TRACT INFECTION, STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT

**KEY WORDS**  
urinary tract infection, infants, children, vesicoureteral reflux, voiding cystourethrography

**ABBREVIATIONS**

SPA—suprapubic aspiration  
AAP—American Academy of Pediatrics  
UTI—urinary tract infection  
RCT—randomized controlled trial  
CFU—colony-forming unit  
VUR—vesicoureteral reflux  
WBC—white blood cell  
RBUS—renal and bladder ultrasonography  
VCUG—voiding cystourethrography

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## abstract

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**OBJECTIVE:** To revise the American Academy of Pediatrics practice parameter regarding the diagnosis and management of initial urinary tract infections (UTIs) in febrile infants and young children.

**METHODS:** Analysis of the medical literature published since the last version of the guideline was supplemented by analysis of data provided by authors of recent publications. The strength of evidence supporting each recommendation and the strength of the recommendation were assessed and graded.

**RESULTS:** Diagnosis is made on the basis of the presence of both pyuria and at least 50 000 colonies per mL of a single uropathogenic organism in an appropriately collected specimen of urine. After 7 to 14 days of antimicrobial treatment, close clinical follow-up monitoring should be maintained to permit prompt diagnosis and treatment of recurrent infections. Ultrasonography of the kidneys and bladder should be performed to detect anatomic abnormalities. Data from the

CLINICAL PRACTICE GUIDELINE Guidance for the Clinician in Rendering Pediatric Care

American Academy of Pediatrics



DEDICATED TO THE HEALTH OF ALL CHILDREN™

# Reaffirmation of AAP Clinical Practice Guideline: The Diagnosis and Management of the Initial Urinary Tract Infection in Febrile Infants and Young Children 2–24 Months of Age

SUBCOMMITTEE ON URINARY TRACT INFECTION

It is the policy of the American Academy of Pediatrics to reassess clinical practice guidelines (CPGs) every 5 years and retire, revise, or reaffirm them. The members of the urinary tract infection (UTI) subcommittee who developed the 2011 UTI CPG<sup>1</sup> have reviewed the literature

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# definition of UTI

- ▶ As such, .....
  - ▶ The definition of UTI is likely to continue
  - ▶ Until new data emerge.
  - ▶ In the meantime, we recommend using the
  - ▶ AAP guideline, in combination with clinical judgement, to determine the likely diagnosis.
- 

# Common Errors in the Diagnosis of UTI in Children

- ❖ Diagnosis based on a contaminated urine specimen
- ❖ Conditions wrongly treated as UTI
  - Asymptomatic bacteriuria (ABU)
  - Sterile pyuria
- ❖ Cystitis versus acute pyelonephritis

# Contaminated urine specimen

- ✓ bag urine specimens can be as high as 80%
- ✓ Insignificant bacterial colony count
- ✓ Presence of  $\geq 2$  pathogens on urine culture
- ✓ Presence of  $\geq 10$  / HPF squamous epithelial cells on urinalysis
- ✓ Growth of non-uropathogens such as :  
*Lactobacillus*,  
*Corynebacterium*,  
*Streptococci viridans* ,  
coagulase-negative staphylococci such  
as *Staph. epidermidis*  
are considered as contaminants in children

# Asymptomatic bacteriuria (ABU)

- ▶ Colonization of the bladder in the absence of an inflammatory reaction
- ▶ occurs at all ages,
- ▶ more common in girls
- ▶ Mainly Gram negative bacteria, such as E coli. incidence is ~1% to 3%
- ▶ usually resolves spontaneously
- ▶ Antibiotic treatment is not recommended for otherwise healthy individuals with ABU ? use promotes antimicrobial resistance and increased risk of symptomatic UTI.
- ▶ Frequently observed in children with neurogenic bladder, particularly if CIC

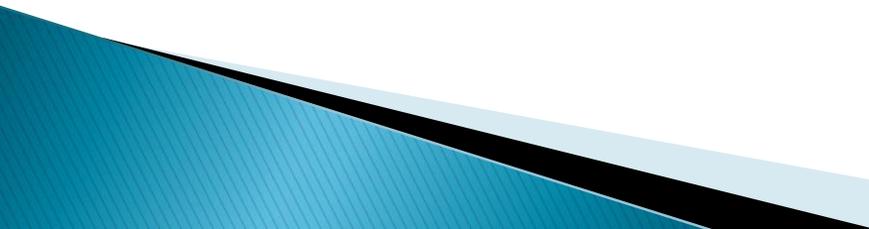
# Asymptomatic bacteriuria (ABU)

- ▶ The key to distinguishing true UTI from asymptomatic bacteriuria is the presence of pyuria.
- ▶ **ABU = Absent pus cells**  
**Positive culture**
- ▶ **true UTI = Positive pus cells**  
**Positive culture**

# STERILE PYURIA

- ▶ partially treated UTI
- ▶ Appendicitis
- ▶ Tuberculosis
- ▶ fungal, viral, or parasitic infections.
- ▶ Acute glomerulonephritis
- ▶ systemic lupus erythematosus
- ▶ Kawasaki disease
- ▶ kidney stones
- ▶ interstitial nephritis,
- ▶ analgesic nephropathy
- ▶ papillary necrosis.

## Acute pyelonephritis versus cystitis

- ▶ Differentiation of APN from cystitis can be difficult particularly in preverbal children, and in the febrile infant
  - ▶ most cases of APN are ascending infection, many patients have both upper- and lower-symptoms
  - ▶ an effort should be made to localize the infection ? acute management and subsequent workup of cystitis and PN may differ
  - ▶ viral or chemical cystitis do not need antibiotic therapy
- 

# COMPLICATIONS OF UTI

## Acute complications of UTI

### General (with any febrile illness )

- ▶ Dehydration
- ▶ electrolyte abnormalities
- ▶ febrile seizures

### Renal complications of APN

- ▶ Renal abscess
- ▶ complete occlusion of a preexisting, partial ureteropelvic junction obstruction.
- ▶ Acute kidney injury
- ▶ papillary necrosis
- ▶ Interstitial nephritis
- ▶ Urosepsis

# LONG-TERM COMPLICATION

- ▶ The most consequential long-term complication of APN is **RENAL SCARRING**.
- ▶ The reported prevalence of renal scarring after febrile UTI is ~15% and ranges from 3% after the first UTI to 29% after >3 febrile UTIs.
- ▶ hypertension
- ▶ proteinuria
- ▶ progressive decline in renal function

# RISK FACTORS FOR RENAL SCARRING

- ▶ high grade of VUR (particularly grades 4 , 5)
  - ▶ duration of fever of  $> 72$  hours before antibiotic initiation
  - ▶ Recurrent UTI
  - ▶ organisms other than E coli
  - ▶ young age: Previously, a young age was considered to be a risk factor, but recent studies have revealed that older children may be at higher risk of renal scarring
- 

# RISK FACTORS FOR RENAL SCARRING

- ▶ the discrepancy may be related to the inclusion of patients with preexisting congenital scarring (renal dysplasia) in the earlier studies because differentiation between congenital and acquired scarring after APN is challenging, particularly when baseline (ie, pre-UTI) studies are not available

# RISK FACTORS FOR RENAL SCARRING

- ▶ genetic predisposition
  - ▶ Polymorphisms of the HSPA1B gene of HSP72 protein
  - ▶ variants of the toll-like receptor 4 gene
  - ▶ polymorphisms of the angiotensin-converting enzyme
  - ▶ transforming growth factor b1 genes.
- 

# RENAL IMAGING AFTER UTI

Renal imaging after UTI is TO :

- ▶ rule out an underlying renal or urinary tract anomaly
- ▶ the assessment of renal injury.



# RENAL IMAGING AFTER UTI

- ▶ Renal Bladder Ultrasound
  - ▶ Voiding Cystourethrogram
  - ▶ DMSA Renal Scan
- 

# RENAL IMAGING AFTER UTI

## AAP Guidelines in Febrile Infants and Children 2 to 24 Months

- Renal bladder ultrasound recommended
- VCUg should not be performed routinely after the first febrile UTI Recommended if-
  - RBUS reveals : hydronephrosis, scarring, or other findings that would suggest either high-grade VUR or obstructive uropathy
  - atypical or complex clinical Course
  - UTI recurrence
- No routine nuclear DMSA scans

# Renal Bladder Ultrasound

to evaluate for

- ▶ urinary tract anomalies
  - ▶ Obstruction
  - ▶ nephrolithiasis
  - ▶ Calcification
  - ▶ abdominal mass
  - ▶ Kidney size
  - ▶ Hydronephrosis
- 

# Renal Bladder Ultrasound

- ▶ RBUS Versus VUR
- ▶ less sensitive imaging modality for the diagnosis of VUR
- ▶ normal RBUS does not rule out high-grade VUR.
- ▶ findings on RBUS may indicate VUR include :
  - ▶ Ureteral dilation
  - ▶ renal parenchymal changes
  - ▶ bladder abnormalities.
- ▶ RBUS cannot be used to accurately diagnose patients with APN or renal scarring.

# Renal Bladder Ultrasound

The 2011 AAP guidelines recommend RBUS :

- ▶ performed in all infants (2–24 months) with febrile UTI
- ▶ Older children with recurrent UTIs

# Renal Bladder Ultrasound

## Time to perform RBUS:

1. Can be deferred until after resolution of UTI
2. During acute episode
  - ▶ if the illness seems atypical course
  - ▶ severe
  - ▶ High fevers persist beyond 48 –72 hr of treatment
  - ▶ suggests complications, such as renal abscess or occult obstruction that are well–seen on RBUS.

# Renal Bladder Ultrasound

- ▶ A deferred RBUS permits more accurate interpretation of the anatomy, without potential for false-positive findings associated with
- ▶ tissue edema .... Changes in the size and shape of the kidneys and the echogenicity of renal
- ▶ parenchyma
- ▶ or endotoxin-induced dilation. could be confused with Hydronephrosis, Pyonephrosis, or obstruction

# Voiding Cystourethrogram

VCUG should be considered after first UTI

- ▶ in children with abnormal RBUS
- ▶ atypical causative pathogen
- ▶ complex clinical course
- ▶ renal scarring.
- ▶ ± Patients with family history of VUR or CAKUT

# Voiding Cystourethrogram

- ▶ In the last decade, the practice patterns have dramatically shifted with far fewer patients undergoing VCUG after an initial UTI
- ▶ the reason for this is that less than one-third of children with their first UTI have VUR, and of these, fewer than 10% have grade 4 to 5 VUR.

# Voiding Cystourethrogram

The AAP recommendation has resulted in a significant decrease in the number of VCUGs performed.

1. primary care physicians may generalize these recommendations to all children., which were intended for children *2-24 mo*,
2. the AAP recommendations were made was that prophylaxis did not reduce the frequency of UTIs but that the Randomized Intervention for Children with Vesicoureteral Reflux (RIVUR) showed a significant reduction in febrile UTIs in children with reflux on prophylaxis.

# DMSA Renal Scan

- ▶ gold standard for assessment of renal scarring
- ▶ It may be considered :
  - children with recurrent febrile UTIs
  - renal parenchymal abnormalities on RBUS.

Time to perform DMSA ?

- ▶ If performed during or shortly after APN  
.....
- ▶ Cortical defects on DMSA scan may be due to preexisting lesions (either acquired or congenital)
- ▶ or to the acute inflammatory reaction associated with APN.

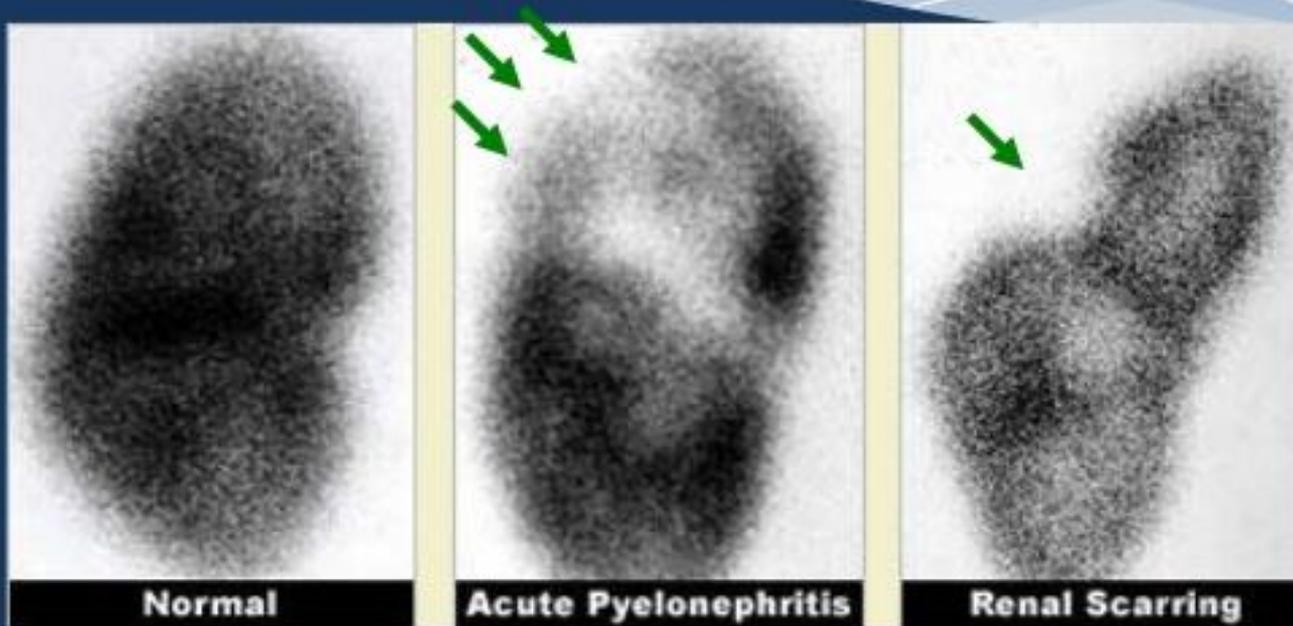
# DMSA Renal Scan

If delayed DMSA scan at 4 to 6 months.....  
allows the acute inflammatory reaction to  
subside, at which point any persistent cortical  
defects can be assumed to **represent permanent  
renal scarring,**

- ▶ although in the absence of baseline (pre-APN)  
scans, it may still be difficult to differentiate  
acquired from congenital lesions

# Renal Cortical Scan

## Renal scar VS acute pyelonephritis



# Treatment of UTI

## AAP Guidelines in Febrile Infants and Children 2 to 24 Months

- Oral or parenteral antibiotics are equally efficacious.
- Treatment duration should be **7 to 14** days
- ▶ Oral antibiotic therapy for **7 to 10 days** is adequate for uncomplicated febrile UTI that responds well to the treatment

# MANAGEMENT:

- ▶ The goals of treatment of acute UTI are:
- ▶ to eliminate the acute infection
- ▶ to prevent complications
- ▶ to reduce the likelihood of renal damage
- ▶ Most children can be treated orally
- ▶ Parenteral route indicated if :
  - ▶ toxic, unable to retain oral intake, compliance

# ANTIBIOTIC TREATMENT

- ▶ empirical therapy should be guided by the local, resistant patterns of uropathogens
- ▶ febrile children:
  - ▶ Third generation cephalosporins
- ▶ children who are not febrile:
  - ✓ First generation cephalosporin,
  - ▶ amoxicillin plus clavulanic acid,
  - ✓ trimethoprim–sulfamethoxazole,
  - ✓ nitrofurantoin.

# ANTIBIOTIC TREATMENT

- ▶ Agents that are excreted in the urine but do not achieve therapeutic concentrations in the bloodstream, such as nitrofurantoin, should
- ▶ not be used to treat febrile infants with UTIs, because parenchymal and serum antimicrobial concentrations may be insufficient to treat pyelonephritis or urosepsis.

# ANTIBIOTIC TREATMENT

- ▶ Response:
- ▶ Fever resolves in 68% in first 24 hours
- ▶ 92% by 72 hours.
- ▶ fever persists beyond 72 hours.....
- ▶ reevaluate the diagnosis and decide whether an RBUS is emergently needed to rule out renal abscess

# ANTIBIOTIC TREATMENT

## ▶ Timing to start :

should be started within 48 hours of fever onset  
delayed treatment increases risk of renal scarring

– Duration :

7 to 14 days is adequate for uncomplicated febrile  
UTI

- ▶ Route : Many studies show children aged  $>2$  mo. can be safely managed with oral antibiotics;
- ▶ thus, hospital admission for treatment should be avoided unless the child is unable to tolerate oral antimicrobial therapy

# ANTIBIOTIC TREATMENT

- ▶ Routine follow-up:
- ▶ urinalysis and culture after the resolution of UTI symptoms are not necessary unless clinically indicated



# Some Empiric Antimicrobial Agents for Parenteral Treatment of UTI

| Antimicrobial Agent | Dosage                                    |
|---------------------|---|
| Ceftriaxone         | 50 – 75 mg/kg,<br>every 24 h              |
| Cefotaxime          | 150 mg/kg per d,<br>divided every 6–8 h   |
| Ceftazidime         | 100–150 mg/kg per d,<br>divided every 8 h |
| Gentamicin          | 7.5 mg/kg per d,<br>Divided every 8 h     |
| Tobramycin          | 5 mg/kg per d,<br>divided every 8 h       |
| Piperacillin        | 300 mg/kg per d,<br>Divided every 6–8 h   |

# Some Empiric Antimicrobial Agents for Oral Treatment of UTI

| Antimicrobial Agent  | Dosage                                   |
|--|--|
| Amoxicillin–clavulanate Sulfonamide                            | 20–40 mg/kg per d in 3 doses             |
| Trimethoprim–sulfamethoxazole and 30–60 mg/kg sulfamethoxazole | 6–12 mg/kg trimethoprim per d in 2 doses |
| Sulfisoxazole Cephalosporin                                    | 120–150 mg/kg per d 4 doses              |
| Cefixime   | 8 mg/kg per d in 1 dose                  |
| Cefpodoxime  | 10 mg/kg per d in 2 doses                |
| Cefprozil  | 30 mg/kg per d in 2 doses                |
| Cefuroxime axetil  | 20–30 mg/kg per d in 2 doses             |
| Cephalexin   | 50–100 mg/kg per d in 4 doses            |

# ANTIMICROBIAL PROPHYLAXIS

- ▶ The RIVUR trial revealed that trimethoprim-sulfamethoxazole prophylaxis reduced the risk of UTI recurrence by 50%.
- ▶ In systematic reviews and meta analyses, researchers have mixed results;
- ▶ Some concluding that prophylaxis is effective
- ▶ others reporting no or little advantage for the prevention of UTI recurrence

# ANTIMICROBIAL PROPHYLAXIS

- ▶ No study has demonstrated any beneficial effect of antimicrobial prophylaxis for the prevention of renal scarring

# ANTIMICROBIAL PROPHYLAXIS

- ▶ The American Urological Association recommends In cases of **febrile UTI and VUR** :
- ▶ children aged <1 year: continuous antibiotic prophylaxis
- ▶ older children : a selective approach based on patient age, severity of VUR, recurrence of UTI, presence of BBD, and renal cortical anomalies

# ANTIMICROBIAL PROPHYLAXIS

- ▶ In all recommendations, **younger age** is a particular consideration for prophylaxis ?
  - Nonspecific clinical presentation for UTI
  - The difficulty in getting urine specimens
  - the higher possibility of a need for hospitalization for IV antibiotic administration and hydration
  - an increased risk of septicemia
  - parental anxiety.

# ANTIMICROBIAL PROPHYLAXIS

- ▶ **preemptive antimicrobial prophylaxis**

may be necessary to lower the risk of first UTI, such as in

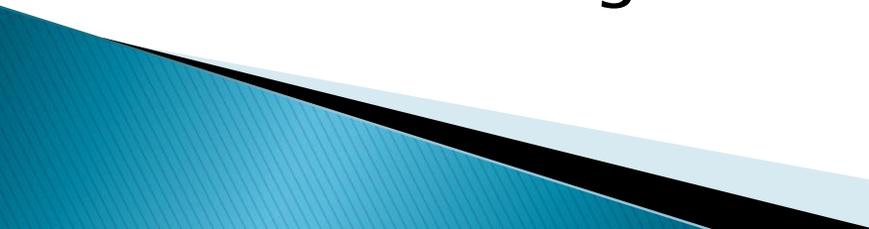
1 those with high-grade VUR

2 Diagnosed antenatal hydronephrosis

# ANTIMICROBIAL PROPHYLAXIS

- ▶ **The duration of prophylaxis**
  - ▶ range from a few days until a VCUG can be obtained in those recently diagnosed with UTI
  - ▶ to a few years for children with VUR on medical management.
- 

# measures reduce risk of antibiotic resistance:

- ▶ Collection of uncontaminated urine specimen for diagnosis
  - ▶ Initiation of empirical antibiotic therapy only after collecting an uncontaminated urine specimen
  - ▶ Avoiding use of antibiotic in a patient suspected of having viral or chemical cystitis
  - ▶ Not using a routine, long-term antimicrobial prophylaxis in low risk patients
  - ▶ Not treating ABU with antibiotics
- 

# SURGICAL INTERVENTION FOR VUR

- ❑ High grade VUR
  - ❑ recurrent UTI despite antibiotic prophylaxis
  - ❑ noncompliance with prophylactic antibiotics
  - ❑ worsening of renal scars
- 

# PREVENTION OF RECURRENT UTI

- ▶ preventing constipation
  - ▶ avoidance of urine withholding behavior
  - ▶ increased oral fluid
  - ▶ In uncircumcised boys, gentle, daily retraction and cleaning
  - ▶ boys with phimosis: topical corticosteroid ointment or circumcision
  - ▶ cranberry juice : There is no evidence
- 

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