

URINARY TRACT INFECTION IN CHILDREN

DIAGNOSIS AND TREATMENT

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URINARY TRACT INFECTION IN CHILDREN

UTI is a common bacterial infection in children

It occurs in children with normal urinary tract

It could be a harbinger of urinary tract abnormality

It causes acute clinical symptoms of infection

It also has long term consequences such as scar ,HTN and CKD

It is important to prevent recurrent UTI

Content of talk taken mostly from 2021 update of EAU/ESPU on UTI,NICE and AAP

RISK FACTORS FOR RENAL SCARRING

- Recurrent febrile UTI
- Delay in treatment of acute infection
- Dysfunctional elimination
- Obstructive malformations
- VUR

EPIDEMIOLOGY AND ETIOLOGY

- In neonates ♂ predominance, non- E. Coli organism and risk of urosepsis is high
- In ♂ highest in 1st 6 MOs 5.3% & ↓ to 2% for the ages of 1-6 yrs
- In girls 2% in the 1st 6 months and ↑ to 11% for the ages 1-6 yrs
- Pooled prevalence of 7.8% in children
- Febrile UTI causes renal scarring
- Each new febrile UTI ↑ renal scarring by 2.8%
- E.coli is the main organism but recent ↑ with other organisms
- Risk factors: bowel bladder dysfunction , VUR and obesity

CLASSIFICATION OF UTI

- Site-----upper , lower, epididymitis
- Severity ----- systemic symptoms or not
- Episode -----1st or recurrent
- Symptoms-----symptomatic or asymptomatic
- Complicating factors-----anatomic abn. Or NI urinary tract

Diagnostic Evaluation

- A detailed history : first or recurrent infections
 - fetal abnormalities
 - Abn.in urinary tract
 - Prior operations
 - Bowel or voiding dysfunctions
 - Family Hx

PE : general P Exam ,growth indices ,abdomen, **genitalia**, flank and back

In neonates and infants: non-specific symptoms , fever, lethargy, vomiting ,jaundice and FTT

In neonates it is important to rule out co-existing meningitis

In toilet trained children cystitis symptoms, suprapubic and flank pain are prominent

IMPORTANT POINTS IN HISTORY AND P/E ON CONFIRMED UTI

- Poor urine flow
- History suggesting previous UTI or confirmed previous UTI
- Recurrent fever of uncertain origin
- Antenatally diagnosed renal abnormality
- Family history of vesicoureteric reflux (VUR) or renal disease
- Constipation
- Dysfunctional voiding
- Enlarged bladder
- Abdominal mass
- Evidence of spinal lesion
- Poor growth
- ↑Blood pressure

URINE SAMPLING

- Urine sampling :before any antibiotic treatment
 - In neonates, infants and non-toilet trained children:
 - Four main method:
 1. urine bag: **50-60%** risk of contamination, negative result is helpful to rule out UTI
 2. Clean-catch :risk of contamination 26% when UC negative rules out UTI
 3. catheterization: fast and safe and reliable with contamination risk of 10%
 4. Suprapubic: the most invasive and most accurate with contamination risk of 1% (**mandatory in Labial adhesion and severe phimosis**)
- To use a 2 step procedure: clean catch U/A if + UC with catheter or suprapubic**

METHODS OF URINALYSIS

- Dipstick
- Microscopy
- Flow imaging analysis technology

GUIDANCE ON THE INTERPRETATION OF MICROSCOPY RESULTS

Microscopy results	Pyuria positive	Pyuria negative
Bacteriuria positive	The infant or child should be regarded as having UTI	The infant or child should be regarded as having UTI
Bacteriuria negative	Antibiotic treatment should be started if clinically UTI	The infant or child should be regarded as not having UTI

INTERPRETATION OF U/A UC

- When nitrite, leukocyte tests and pyuria or bacteriuria are negative
 No need for UC specially when there is an alternative DX for the fever
- If U/A + confirmation by UC is essential
- UC could be done by midstream , catheterization or suprapubic
- UC is considered + if $10^3 - 10^4$ cfu /ml of a monoculture
- Suprapubic UC any number is considered +
- Mixed culture is contamination
- In febrile infants <4 Mo with an appropriate method cut-off value is 10^3 cfu/ml
- Pyuria with negative UC

INDICATIONS FOR URINE CULTURE

- In infants and children who are suspected to have acute pyelonephritis/upper urinary tract infection
- In infants and children with a high to intermediate risk of serious illness
- In infants under 3 months
- In infants and children with a positive result for leukocyte esterase or nitrite
- In infants and children with Hx of recurrent UTI
- In infants and children with an infection that does not respond to treatment within 24–48 hours, if no sample has already been sent
 - When clinical symptoms and dipstick tests do not correlate

AAP ACTION STATEMENT

If a febrile infant is assessed as not requiring immediate antimicrobial therapy, then the likelihood of UTI should be assessed

- If likelihood* is low (<1-2%), it is reasonable to follow the child clinically
- If the likelihood is not low, there are two options:
 - Obtain specimen by catheter for UA ,UC
 - Obtain specimen by any means for UA and only culture those with positive UA

*LR: hx of previous UTI, $T \geq 39^{\circ}\text{C}$, FWLS, ill appearance, suprapubic tenderness, fever >24h, nonblack

IMAGING IN UTI

- **Diagnostic evaluation has been changed over time**
- To ensure any urinary tract abnormality with the 1st febrile UTI
- US is the 1st imaging and must be done in all infants with febrile UTI
- **US to be done within 24hr in infants to exclude the obstruction in upper and lower urinary tract**
- Abnormalities are found in 15% and 1-2% may require prompt action (drainage or diversion)
- US to be done pre and post void in toilet trained children
- When there is question of **mass** or abscess to confirm with CT scan

IMAGING IN UTI

- Renal DMSA scan with perfusion defect reveal pyelonephritis in acute phase up to 6 weeks
- Renal scars can be detected after three to six months
- Diffusion-weighted MRI is an alternative to DMSA scan for accurate diagnosis of acute pyelonephritis and late renal scars without radiation

IMAGING IN UTI:VCUG

- It is gold standard diagnostic test for vesico-ureteral reflux (VUR)
- VCUG can also exclude the presence of an infravesical obstruction
- The timing of VCUG does not influence the presence or severity of VUR
- When performed with proven sterile urine, it does not cause any **significant morbidity**
- High grade VUR is an important risk factor for renal scarring
- The most important risk factors for high-grade VUR : abnormal renal US, high grade fever and non-E. Coli infections
- Regarding the invasiveness of VCUG and radiation exposure to have a comprehensive diagnostic strategy for limitation of number of VCUG
- **RNC**

Recommendations from clinical practice guidelines for routine investigations in UTI

Investigation	NICE 2007	NICE 2007	AAP 2011	ISPN 2012	EAU/ESPU
Age	< 6mo	6-36 mo	2-24 mo	2-36 mo	Infants and children
US during UTI	No unless poor resp . to Rx or atypical UTI	No unless atypical UTI	Yes if very unwell	Yes if poor response to Rx	Yes within 24 hr
Later US	Yes	No	Yes *	Yes*	No
DMSA scan at 4-6 mo later	No unless atypical* UTI	No unless atypical* UTI	No recommendation	No unless Abn. US/VCUG	Yes For recurrent UTI and VUR
VCUG	No unless atypical* UTI/Abn.US	No unless Abn.US, + FHx VUR*	No unless Abnormal US*	No unless Abnormal US	Yes for infants & abn. US ,non-E.Coli &Recurrent feb UTI

DEFINITIONS OF ATYPICAL AND RECURRENT UTI

- **Seriously ill**
- **Poor urine flow**
- **Abdominal or bladder mass**
- **Raised creatinine**
- **Septicemia**
- **Failure to respond to Rx with suitable antibiotics within 48 hrs**
- **Infection with non-E. coli organisms**
- **Recurrent UTI**
 - Two or more episodes of acute pyelonephritis
 - One episode of acute pyelonephritis + one or more cystitis
 - Three or more episodes of cystitis/lower urinary tract infection

MANAGEMENT OF UTI

- Hospitalization Versus outpatient
- Oral vs Parenteral:
 - patients age ,clinical suspicion of urosepsis , refusal of food , fluid and oral medication , vomiting , diarrhea and complicated pyelonephritis , compliance
 - In newborns and infants less than two months due to high incidence of urosepsis and severe pyelonephritis IV antibiotic RX
 - **Electrolyte disorders with life-threatening hyponatremia and hyperkalemia based on pseudo-hypoaldosteronism can occur in obstructive conditions**

Management of UTI

Indications for admission

- Age < 2-3mo,
- septic, dehydrated, vomiting,
- immunocompromised , single kidney, known gross anatomical abnormality or obstruction,
- Recent treatment for UTI and recent instrumentation
- Patients from far distances and **non-compliant**

ANTIMICROBIAL AGENTS

- **Antibiotic resistance pattern is different in different countries**
- High resistance patterns in countries outside The OECD*
- Several risk factors and determinants for UTIs caused by ESBL and non-E Coli bacteria
- Hx of infection, recent hospitalization, antibiotic exposure and prophylaxis
- Choice of antibiotic is a difficult decision
- To be aware of local resistance pattern
- Local antibiotic protocols
- Web based recommendations
- The individual patients' previous cultures

* Organization for Economic Cooperation and Development (OECD)

DURATION OF THERAPY

- Prompt adequate treatment of UTI can prevent the spread of infection and subsequent **renal scarring**
- Outcomes of short courses (one to three days) are inferior to those of seven-to-fourteen-day courses
- A simple cystitis 3-5days of Rx
- Pyelonephritis 7-14 days
- Young infants a short course of IV antibiotic with rapid conversion to a **susceptible oral antibiotic**
- In case of out-patient Rx: active surveillance, medical supervision , **antibiogram result and adjustment of Rx**, Close contact with the family
- In complicated UTI the causative organisms are mostly Proteus Mirabilis, Pseudomonas Aeruginosa and they may need complementary treatments : urinary diversion ,.....
- **Malpractice ???**

MONITORING OF UTI

- With successful treatment, urine usually becomes sterile after 24 h (2nd UC?)
- Leukocyturia disappears within three to four days
- Normalization of body temp. within 24-48 h in 90% of patients
- If prolonged fever: think of obstruction, congenital uropathy and treatment-resistant uropathogen and need for repeat US
- Procalcitonin , CRP and leukocyte count can be used as reliable serum markers for renal parenchymal inflammation.
- In patients with febrile UTI, check serum electrolytes and blood count

PREVENTATIVE MEASURES in UTI

- Recurrent UTIs: bothersome symptoms, and renal scarring
- Chemoprophylaxis: is commonly used to prevent UTIs in children
 - Regarding ↑resistance individualization needed
 - long-term use has been associated with ↑ microbial resistance
 - It ↓ the number of recurrent UTIs, but it did not reduce new scars
- In children with anatomic abnormalities of the urinary tracts a reduction in UTI and subsequent renal scarring was shown
- Patients with incomplete emptying of the bladder appropriately performing CIC, but still suffering from recurrent UTIs the intravesical application of Gentamicin has been proven effective

PREVENTATIVE MEASURES in UTI

- Dietary supplements

- Cranberry juice ↓ the risk of UTIs in healthy children, and in children with urogenital abnormalities

- probiotics conflicting results

- Vitamin A showed promising results in preventing renal scarring in children with acute pyelonephritis

- Vitamin E could possibly ameliorate the symptoms of UTI

- In newborns with an anatomical abnormality circumcision may also prevent UTIs

- Bladder and bowel dysfunction (BBD) is a risk factor for UTI

- Normalization of micturition disorders or bladder overactivity ↓the risk of recurrent UTI

- Treatment of constipation ↓the risk of recurrence of UTI**

- Exclusion of BBD is strongly recommended in any toilet-trained child presenting with febrile and/or recurrent UTI

Follow up UTI

Recommendation AAP

Following confirmation of UTI, parents or guardians should be instructed to seek prompt medical evaluation for future febrile illnesses to ensure that recurrent infections can be detected and treated promptly

FLOWCHART FOR BASIC DIAGNOSTIC EVALUATION AND SUBSEQUENT MANAGEMENT OF UTI

Febrile child with clinical symptoms → PE → nitrite-/leukocyte-
CBC,CRP+,Procal.+/_ → UA and dipstick → nitrite-/leukocyte-
,microscopy – exclude other causes

→ Nitrite + and or leukocyte +/microscopy + → UC and start antibiotic

Waiting for UC and antibiogram

FLOWCHART FOR COMPREHENSIVE DIAGNOSTIC EVALUATION USING RISK FACTORS

- First Feb UTI → KUB US → NI → non-E.Coli → VCUG
→ E.Coli in infants → VCUG
→ age > 12mo → VCUG if recurrent feb. UTI

If abn.KUB US (dilatation of upper tract or obst.stone or abscess → complicated UTI → IV antibiotics decision according to clinical response / may need further imaging and **surgery**)

THANK YOU