Urinary Tract Infections: A Practical Approach

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Overview

1. Epidemiology
2. Definitions and diagnosis
3. Acute management
4. Prevention

(Practical Points)

1. Epidemiology

- **Major gender differences**
- **Boys**
  - disease of infancy (<1 year)
  - peak incidence during neonatal age, then linear reduction to 1 year of age
  - more common in boys than girls during the first year of life
  - overall cumulative incidence during childhood about 3%

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1. Epidemiology

- **Girls**
  - peak incidence at 6-12 months
  - long tail of risk
  - more common in girls > 6 months
  - overall cumulative incidence during childhood is about 8% (about double in males)

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1. Epidemiology

- **Febrile UTIs (i.e. acute pyelonephritis) are the most common serious bacterial infection of childhood**
  - about 5% of children presenting with fever will have UTI

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2. Definitions

- **Symptomatic bacteriuria**
  - bacteriuria + symptoms
    - Afebrile UTI (i.e. T≤ 38◦C in cystitis)
    - Febrile UTI (i.e. acute pyelonephritis in 80%)
- **Asymptomatic bacteriuria**
  - also known as covert or latent
  - bacteriuria in well children
  - 1-2% prevalence
  - treatment confers no benefit, only harm

2. Definitions

- **Atypical**
  - Seriously ill
  - Poor urine flow
  - Abdominal/bladder mass
  - Low GFR
  - Septicaemia
  - Non-response to suitable antibiotics in 48 hours
  - Non-E. Coli organisms
- **Recurrent**
  - ≥ 2 febrile UTIs
  - 1 febrile UTI + ≥ 1 cystitis
  - ≥ 3 cystitis

Clinical Practice Guidelines

AAP (2011)	NICE (2007)	PPS (2004)
Action Statement 2: If a clinician assesses a febrile infant with no apparent source for the fever as not being ill as to require immediate antimicrobial therapy, then the clinician should assess the likelihood of UTI.	Infants and children presenting with unexplained fever of 38°C or higher should have a urine sample tested after 24 hours at the latest.	Febrile infants (>38°C) below 2 years of age

Clinical Features

- **Age dependent**
- **< 2 years**
  - non specific febrile illness
  - fever/irritability/lethargy/vomiting and/or diarrhoea
- **≥ 2 years**
  - most have localising symptoms
  - frequency/dysuria/abdominal pain

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

Individual Risk Factors: Girls
White race
Age < 12 mo
Temperature ≥ 39°C
Fever ≥ 2 d
Absence of another source of infection

Probability of UTI	No. of Factors Present
≤1%	No more than 1
≤2%	No more than 2

Individual Risk Factors: Boys
Nonblack race
Temperature ≥ 39°C
Fever > 24 h
Absence of another source of infection

Probability of UTI	No. of Factors Present	
	Uncircumcised	Circumcised
≤1%	a	No more than 2
≤2%	None	No more than 3

FIGURE 2

Probability of UTI Among Febrile Infant Girls[28] and Infant Boys[30] According to Number of Findings Present. [a]Probability of UTI exceeds 1% even with no risk factors other than being uncircumcised.

Practical Point #1

Always consider UTI among children < 24 months presenting with fever without a focus.

Clean Catch: *Easy Said than Done*

- **Perez reflex technique**
  - Within 5 minutes of a feed in infants, perform the Perez reflex
  - Holding the infant prone over a sterile urine container and gently stroking the back
  - (+) reflex: the child's whole body will extend
- **Finger tap method**
  - 2 fingers "just above pubis", 1 h after feeding
  - 1 tap/sec for 1 min, rest 1 min, repeat
  - 77 % success within 10 min (Broomhall, BMJ 1985)
  - Mean time to success 5.5 min, Longest time 20 min (Taylor, BMJ 1986)

Clinical Practice Guidelines

AAP (2011)	NICE (2007)	PPS (2004)
Action Statement 1 and 3: The diagnosis of UTI cannot be established reliably through culture of urine collected in a bag. Urine specimen should be obtained through catheterization or SPA.	A clean catch urine sample is the recommended method for urine collection. If it is unobtainable, catheter samples or SPA should be used.	For infants < 1 year old, SPA is recommended. A catheterized urine is a good alternative to obtain urine specimen. Midstream urine collection for cooperative patients.

Practical Point #2

The value of a urine “wee” bag is when it is negative.

Clinical Practice Guidelines

AAP (2011)	NICE (2007)	PPS (2004)
Action Statement 2b: Urinalysis results suggest a UTI is (+) LE or nitrite or microscopic analysis (+) leucocytes or bacteria.	< 3 years old: Use urgent microscopy and culture to diagnose UTI. ≥ 3 years old: Use dipstick test to diagnose UTI. Bacteriuria more specific.	GS on an uncentrifuged urine specimen has the best sensitivity and false positive rate.

Practical Point #3

- If the aim is to detect all children with UTI then a culture is always required
- In a low prevalence setting (eg. children with fever and no other symptoms) urinalysis (either leucocyte esterase or nitrites) will detect nearly all
- Urine microscopy for bacteria is the best test

Practical Point #3

Pyuria is not always UTI.

Clinical Practice Guidelines

AAP (2011)	NICE (2007)	PPS (2004)
Action Statement 3: To establish diagnosis of UTI, clinicians should require BOTH urinalysis results (pyuria and/or bacteriuria) AND the presence of at least 50,000 CFUs per ml of a uropathogen.	No statement	SPA: any number Catheter: symptoms + 50,000 CFUs/ml Clean-catch: symptoms + $\geq 10^5$ CFUs/ml Clean-catch:asymptomatic + $\geq 10^5$ CFUs/ml in at least 2 specimens on different days

2. Diagnostic Criteria

- **Symptoms of UTI *plus* significant counts of bacteria in the urine**
- **Definite UTI**
  - bladder tap: any growth
  - catheter: ≥ 10^4/mL
  - voided: ≥ 10^5/mL
  - single organism

Practical Point #4

- First ask how the urine sample was collected and handled before acting on it.
  - At least 4 hours in the bladder before sampling
  - Processed within 30 minutes (fresh) or within 6 hours in 4°C
- Only treat symptomatic children
- ≥ 10^4/mL in a voided sample in a symptomatic child = UTI

Clinical Practice Guidelines

AAP (2011)	NICE (2007)	PPS (2004)
Action Statement 4a: The clinician should base the choice of agent on local antimicrobial sensitivity patterns.	Laboratories should monitor resistance patterns of urinary pathogens and advise prescribers accordingly.	No statement.

Etiopathogenesis

Typical

- *Escherichia coli*
- *Klebsiella*
- *Proteus*
- *Staphylococcus saprophyticus*

Atypical

- *Enterococci*
- *Pseudomonas*
- *Staphylococcus aureus*
- *S epidermidis*
- *Haemophilus influenzae*
- *Group B streptococci*

Clinical Practice Guidelines

AAP (2011)	NICE (2007)	PPS (2004)
Action Statement 4b: The clinician should choose 7 to 14 days as the duration of antimicrobial therapy.	3 months to 3 years old with febrile UTI: 7-10 days 3 months to 3 years old with afebrile UTI: 3 days	No statement

Back to Basics: Half-life of Antimicrobials

Antimicrobials	Half-life (hrs)
AMIKACIN	2-5
AMOXICILLIN	1-2
CEFALEXIN	1-3
CEFUROXIME	1-2
CO-AMOXYCLAV	1
CEFTRIAXONE	5-9
CHLORAMPHENICOL	1-3

Clinical Practice Guidelines

AAP (2011)	NICE (2007)	PPS (2004)
Action Statement 4a: The clinican should base the choice of route of administration on practical considerations. PO or IV is equally efficacious.	3 months to 3 years old with febrile UTI: oral or IV then oral 3 months to 3 years old with afebrile UTI: oral	No statement

Practical Point #5

- Know half-lives of common antimicrobials.
- Febrile UTI, 7-10 days
  - First-line, oral antibiotics
  - Intravenous antibiotic for:
    - children who are unable to take antibiotics (<5%)
    - very unwell children
    - infants under 3 months
    - until fever resolves
- Afebrile UTI, 3 days for **first-time or non-recurrent**

Clinical Practice Guidelines

AAP (2011)	NICE (2007)	PPS (2004)
Action Statement 5: Febrile infants with UTIs should undergo renal and bladder ultrasonography.	In all children with severe or atypical illness who do not respond to treatment within 48 hours, early ultrasound scan is recommended to identify structural abnormalities of the urinary tract. In children over 6 months of age with simple first time UTI that responds to treatment, routine ultrasound is not recommended.	Ultrasonography alone as a work-up for patients with proven UTI is inadequate.

4. Preventative Strategies

- Imaging
- Long-term low dose antibiotics
- Re-implantation surgery
- Cranberry juice
- Circumcision for boys

Practical Point #6

- Childhood UTI connotes either an anatomic or functional abnormality of the GUT.
- Ultrasound in all.
- Timing is critical.
  - False-negative: immediately after birth
  - False-positive: acute infection
  - For atypical/recurrent UTI: first 2 days
  - For good response:within 6 weeks

Clinical Practice Guidelines

AAP (2011)	NICE (2007)	PPS (2004)
No action statement	Do not routinely use antibiotic prophylaxis after first-time UTI but consider it after recurrent UTI.	Implied to start prophylactic antibiotics

Practical Point #7

- Antibiotics should not be used routinely
  - Consider in high risk groups
    - High risk of recurrence
      - Recurrent symptomatic UTI
      - Abnormal DMSA
      - Grades III+ reflux
    - Infants with severe index infection

Summary

- Who to treat
  - Only symptomatic children
  - ≥ 10^4/mL in a voided sample in a symptomatic child
- How to diagnose
  - If the aim is to detect all children with UTI then a culture is required in all
  - In a low prevalence setting (eg children with fever and no other symptoms) treat those with a positive urinalysis (either leucocyte esterase or nitrites) and don't treat those with a negative urinalysis
  - Urine microscopy for white cells should be abandoned
  - If you want to use the best test do a urine microscopy

Summary

- How to treat (use local sensitivity data)
  - Febrile UTI, 7-10 days
    - First-line, oral antibiotics
    - Intravenous antibiotic for:
      - children who are unable to take antibiotics (<5%)
      - very unwell children
      - infants under 3 months
      - until fever resolves
  - Afebrile UTI, 3 days
- How to investigate
  - US only

Summary

- Antibiotics should not be used routinely
  - Consider in high risk groups
    - High risk of recurrence
      - Recurrent symptomatic UTI
      - Abnormal DMSA
      - Grades III+ reflux
    - Infants with severe index infection

Practical Point #8

The most practical approach is to advise the children, parents, and carers on recognising symptoms quickly, the possibility of a UTI recurring, and the importance of being vigilant and seeking prompt treatment from a healthcare professional.