URINARY TRACT INFECTION (UTI) IN CHILDREN

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Goals for Treatment of UTI

- Elimination of infection and prevention of sepsis
- Relief of acute symptoms
- Prevention of recurrence and long-term complications including hypertension, renal scarring and impaired renal growth and function

Who should be tested for UTI?

1. Infants and children presenting with unexplained fever of 38 C or higher should have a urine sample tested within 24 hours.
2. Infants and children with an alternative site of infection should not have a urine sample tested. But if they remain unwell, urine testing should be considered after 24 hours at the latest.
3. Infants and children with symptoms and signs of UTI should have a urine sample tested for infection.

Risk Factors for UTI

- Poor urine flow
- History suggesting previous UTI or confirmed previous UTI
- Recurrent fever of uncertain origin
- Antenatally diagnosed renal abnormality
- Family history of vesicoureteral reflux or renal disease
- Constipation
- Dysfunctional voiding
- Enlarged bladder
- Abdominal mass
- Evidence of spinal lesion
- Poor growth
- High blood pressure

Dysfunctional voiding/incomplete bladder emptying

- Detailed history of frequency, urgency, prolonged voiding intervals
- Perineal of penile pain
- Holding manoeuvres
- Constipation
- Encoparesis
- Upto 50% of children with UTI (and majority with recurrent UTIs) have abnormal voiding history

Clinical Differentiation between Acute Pyelonephritis/Upper UTI and Cystitis/ Lower UTI

- **Acute pyelonephritis/upper UTI:** bacteriuria and fever of 38 C or higher or those presenting with fever lower than 38 C with loin pain/tenderness and bacteriuria
  - May lead to renal scarring, hypertension and end-stage renal dysfunction

- **Cystitis/ lower UTI**: bacteriuria with no systemic symptoms or signs

Atypical UTI

1. Age < 3 months (Febrile infants < 3 months who present with fever generally require septic work-up and intravenous antibiotics regardless of whether a UTI is suspected)
2. Any seriously ill child
3. History of poor urine flow
4. Abdominal or bladder mass palpable
5. Raised creatinine
6. Septicaemia
7. Toxic/vomiting
8. Failure to respond to suitable antibiotics within 48 hours
9. Infection with non- E. coli organisms

Recurrent UTI

Children with

a. Two or more UTIs with acute pyelonephritis/ upper UTI

b. A UTI with acute pyelonephritis/ upper UTI and 1 or more UTI with cystitis/lower UTI

c. Three or more UTIs with cystitis/lower UTI

N.B. Patients with recurrent UTI may still be considered to have typical UTI with each presentation and be treated accordingly.

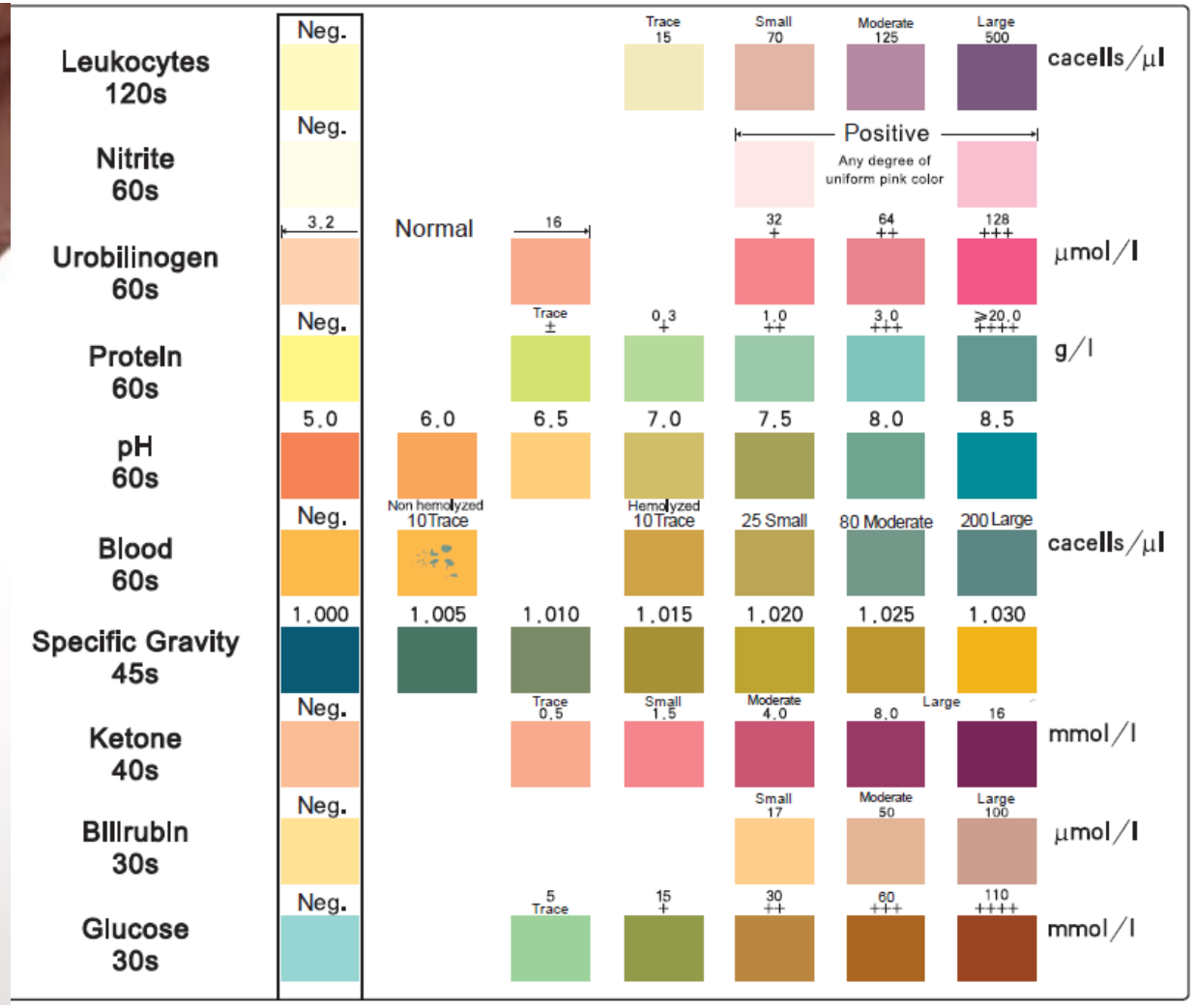
Urine Collection

- Preverbal (< 3 years), not toilet –trained or unable to provide a specimen on demand- in/out catheter specimen is preferred
- < 12 months- Clean catch specimen or suprapubic specimen if a catheter specimen is unable to be obtained. A suprapubic specimen should occur after there is confirmation via ultrasound of urine present in the bladder
- If able to verbally communicate, toilet-trained or able to provide urine specimen on demand- clean catch specimen
- If male and circumcised- clean catch specimen

Contamination rate

- Bag urine 50%
- Clean catch urine/ midstream urine 25%
- Catheter specimen 10%
- Suprapubic aspirate 1%

Urine Dipstick



Urine dipstick

- Urine dipstick is a useful screening test to guide initial management
- The presence of leucocytes and nitrites is suggestive of a UTI.
- Dipstick results are less reliable in neonates and young infants, particularly due to false negatives.

Urinalysis: For children 3 years or older

Urinalysis result	Implications	Management	Further Testing
(+) Leukocyte esterase **(+) Nitrite**	Consistent with UTI	Commence antibiotics	Send urine for MCS
(+) Leukocyte esterase **(-) Nitrite**	Treat as UTI if clinically indicated	Consider antibiotics	Send urine for MCS and consider infection outside the urinary tract
(-) Leukocyte esterase **(+) Nitrite**			Send for MCS
(-) Leukocyte esterase **(-) Nitrite negative**	Do not treat as UTI	Antibiotics for UTI should not be started	Unlikely to be a UTI, consider other causes of illness unless child is < 3 year of age. Urine MCS is usually sent.

Indications for Urine Culture

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

Urinalysis: For children 3 months-3 years

- (-) Leukocyte esterase and (-) nitrites: Do not start antibiotic treatment; do not send a urine sample for MCS unless one of the criteria for urine culture is present.
- (+) Leukocyte esterase or (+) Nitrite or Both (+): Start antibiotic treatment; send a urine sample for culture

Urine Microscopy & Culture

Microscopy Result	Pyuria Positive	Pyuria Negative
Bacteriuria positive	Should be regarded as having UTI	Should be regarded as having UTI
Bacteriuria negative	Antibiotic should be started if clinically UTI	Should not be regarded as having UTI

Minimum counts of colony forming units (CFU) grown on urine culture to be considered as diagnostic of UTI

- Supra-pubic aspiration: any growth
- Catheter specimen: > 10^8 CFU/L (10^6-10^8 CFU/L: possible UTI)
- MSU/Clean catch: > 10^8 CFU/L (10^7-10^8 CFU/L: possible UTI)
- Bag/pad/cotton ball: not recommended for definitive culture

Urine for microscopy and culture

- Laboratory microscopy can complement dipstick results to guide initial management
- Bacteria and leucocytes on microscopy are suggestive of UTI.
- Epithelial cells (squames) suggest skin contamination and a poorly collected sample. Consider recollection.
- A positive culture with sufficient growth and pyuria confirms UTI
- Growth of a single organism at >108 CFU/litre (>105CFU/ml) from any collection method suggests infection
- Growth of a single organism at lower counts of 106-8 CFU/litre (>103-5CFU/ml) from catheter or SPA urine suggests infection, and from clean catch or MSU may indicate early infection
- Growth of any amount from SPA suggests infection.

Treatment of UTI

- Oral antibiotic treatment should be commenced following identification of a suspected typical UTI in a child who is relatively well and tolerating oral intake.
  - Recommended oral antibiotic treatment
    - Cephalexin 12.5 – 25 mg/kg/dose (max 1 g/dose) four times daily
    - Trimethoprim-sulfamethoxazole 4/20 mg/kg/dose twice daily (max dose trimethoprim 320 mg, sulfamethoxazole 1600 mg/day); dose is usually specified based on trimethoprim component)
    - Amoxycillin-clavulanic acid 22.5 mg/kg/dose twice daily based on amoxicillin component
  - Oral antibiotic treatment duration:
    - If afebrile- 4 days
    - If febrile- 7 days
- The child with suspected typical UTI who is unwell or unable to tolerate oral intake and hence oral antibiotics should be commenced on intravenous fluids and IV antibiotic treatment.

IV antibiotics treatment of UTI

- Infants or children with a high risk of serious illness
- Infants younger than 3 months should be treated with parenteral antibiotics

Notes on Antibiotic Therapy

- If an infant or child is receiving prophylactic medication and develops an infection, treatment should be with a different antibiotic, not a higher dose of same antibiotic.
- Asymptomatic bacteriuria should not be treated with antibiotics and should not be given prophylactic antibiotics.
- Antibiotic prophylaxis should not be routinely recommended in infants and children following first-time UTI
- Antibiotic prophylaxis may be considered in infants and children with recurrent UTI.

Medical Follow-up

- Medical follow-up should include reviewing the child's clinical state, ensuring oral antibiotics compliance, checking blood culture and antibiotic sensitivities and altering the antibiotic accordingly if required.

- Medical review should Include arrangement of any appropriate renal imaging.

Imaging studies

- Imaging typically is delayed 3-6 weeks after the infection as part of outpatient follow-up, except in cases in which urinary tract obstruction/atypical UTI/recurrent UTI is suspected.
- Renal ultrasound
- This study adequately depicts kidney size and shape, but it poorly depicts ureters and provides no information on function.
- A renal ultrasound can diagnose urolithiasis, hydronephrosis, hydroureter, ureteroceles, and bladder distention and has replaced the intravenous pyelogram (IVP) in many cases.

Imaging studies

- **Nuclear cortical scanning**
- This study most frequently uses technetium Tc 99m dimercaptosuccinic acid (DMSA).
- This study detects tubular damage and scarring and shows the kidney outline, but it does not show the collecting system.

- **A micturating cystourethrogram (MCUG)** adequately depicts urethral and bladder anatomy and detects vesicoureteral reflux (VUR).

Renal Imaging Recommendations for UTI Infants < 6 months

Test	Responds well to treatment within 48 hours	Atypical UTI	Recurrent UTI
Ultrasound during acute infection	No	Yes[c]	Yes
Ultrasound within 6 weeks	Yes[b]	No	No
DMSA 4- 6 months following the acute infection	No	Yes	Yes
MCUG	No	Yes	Yes

Renal Imaging Recommendations for UTI Infants and Children 6 months - 3 years

Test	Responds well to treatment within 48 hours	Atypical UTI	Recurrent UTI
Ultrasound during acute infection	No	Yes[c]	No
Ultrasound within 6 weeks	No	No	Yes
DMSA 4- 6 months following the acute infection	No	Yes	Yes
MCUG	No	No[b]	No[b]

Renal Imaging Recommendations for UTI Children 3 years or older

Test	Responds well to treatment within 48 hours	Atypical UTI	Recurrent UTI
Ultrasound during acute infection	No	Yes[bc]	No
Ultrasound within 6 weeks	No	No	Yes[b]
DMSA 4- 6 months following the acute infection	No	No	Yes
MCUG	No	No	No

Renal ultrasound can be considered in children who:

- Have concurrent bacteraemia
- Age < 3 months
- Have a culture with atypical organisms
- Lack a response to 48 hours of antibiotic if sensitive organism
- Have renal impairment or significant electrolyte derangement
- Have an abdominal mass
- Have a poor urinary stream

Medical Follow-up

- **Prophylactic antibiotics** following typical UTI is not recommended.
- Children with recurrent UTI or abnormal imaging should be assessed by a paediatric specialist.
- Assessment of children with renal parenchymal defects should include height, weight, blood pressure and routine testing for proteinuria.
- Children with a minor, unilateral parenchymal defect do not need long term follow-up unless they have recurrent UTI or family history or lifestyle risk factors for hypertension.

- Children with bilateral renal abnormalities, impaired kidney function, raised blood pressure and/or proteinuria should receive monitoring and appropriate management by a paediatrician/nephrologist to slow the progression of chronic kidney disease.
- Children who are asymptomatic following an episode of UTI should not routinely have their urine re-tested for infection.

Prevention of Recurrence

- Dysfunctional elimination syndromes and constipation should be addressed in infants and children with UTI.
- Children who have had a UTI should be encouraged to drink an adequate amount.
- Children who have had a UTI should have ready access to clean toilets when required and should not be expected to delay voiding.

Indications for Referral to a Paediatrician/Nephrologist/Urologist

- Dilating vesicoureteral reflux (Grade III – V) or obstructive uropathy
- Renal anatomic abnormalities
- Impaired kidney function
- Elevated blood pressure
- Bowel and bladder dysfunction refractory to primary care measure

Take home messages

- Signs and symptoms of UTI can be non-specific in young children
- Collecting urine to exclude UTI is not required if there is another clear focus of fever and the child is not unwell
- Urinary dipstick is a useful screening test, but a positive urine culture with pyuria confirms the diagnosis
- Oral antibiotics are appropriate for most children with UTI. Children who are seriously unwell and most infants under 3 months usually require IV antibiotics
- Seriously unwell children, those with renal impairment, and boys <3 months of age should have a renal ultrasound prior to discharge to exclude renal tract obstruction.

Any questions?