

## The Big 3: Strep throat, otitis media, UTI

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Available: 24 hours/day, 7  
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## Streptococcal pharyngitis

- When to suspect
- How to make the diagnosis
- How to treat

## Prevalence of streptococcal pharyngitis and streptococcal carriage in children: a meta- analysis

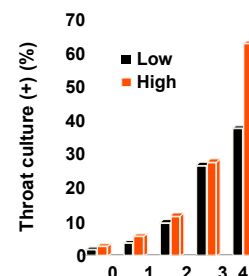
- Shaikh N, Leonard E, Martin JM.
- University of Pittsburgh School of Medicine
- *Pediatrics* 2010;126:e557-e564

## Strep prevalence Results

- 515 articles found; 29 articles included.
- Pooled prevalence of GAS cultured from children with sore throat
  - All ages = 37% (95% CI = 32%-43%).
  - Age < 5 years = 24% (95% CI = 21%-26%).
- Pooled prevalence of GAS cultured from asymptomatic children
  - All ages = 12% (95% CI = 9%-14%).
  - Age < 5 years = 4% (95% CI = 1%-7%).

## Centor (McIsaac) scoring system *Can Med Assoc J* 1998;158:75

- One point each:
  - T > 38°C
  - Absence of cough
  - Tonsillar swelling
  - Tender anterior cervical adenitis.
- Prevalence of GAS = 14%



### Streptococcal infection < 3 years old

- 60 children; 60% serology (+)
- Site: throat 77%, nose 60%, skin 20%
  - Nasal culture solitary positive in 19%
  - Culture (+) and serology (+) usually had pharyngeal, palatal, uvular erythema
- Most children > 18 months old
- 90% had colds, pharyngitis, or both
  - Excoriation or red philtrum not common
  - *Pediatr Infect Dis J* 1988;7:581

### When to suspect

- Minimum
  - Throat, uvula, palatal or tonsillar erythema.
- Better
  - Centor Scoring System
    - T > 38°C
    - Absence of cough
    - Tonsillar swelling
    - Tender anterior cervical adenitis.

Clinical judgment best predicts who does **not** have streptococcal pharyngitis

- Presence of “clinical strep throat”
  - Predictive value for culture (+) = 36%
- Presence of “clinical non-strep throat”
  - Predictive value for negative culture = 97%
  - Predictive value for no rise in serology = 98%
  - *Pediatr Infect Dis J* 1987;6:556
- And you can smell it too (70% PPV)!
  - *Lancet* 1994;343:729-30

### Interobserver agreement in diagnosis

- 200 children with sore throat evaluated in ED at Milwaukee Children’s Hospital by attendings and residents
- Pictorial prompts as teaching device
- K calculations performed for coryza, tonsillar size-erythema-exudate, rash, adenopathy, palatal petechiae
- No K exceeded 0.5 (poor-fair)
- *Pediatr Emerg Care* 2005;21:238-241

Statement of American Heart Association Council on rheumatic fever and congenital heart disease.  
*JAMA*. 1953;151:141–143.

- The Committee: Burtis Breese, Chairman, Drs. Rammelkamp and Massell from the Warren Air Force Base study group and 4 other physicians.
- “To be effective, therapy should be continued for the entire 10 days even though the temperature may return to normal and the patient may feel better within 1 or 2 days.”
- No literature citations or further justification.

**TABLE 1.** Duration of Antimicrobial Therapy for Common Infections

Year Published	Textbook	Meningitis	Pneumonia	Streptococcal Pharyngitis	Urinary Tract Infection	Acute Otitis Media
1942	Nelson	NDM	NDM	NDM	NDM	NDM
1945	Nelson	Clinical	NDM	NDM	Sterile urine	NDM
1950	Nelson	10 days	NDM	5 days	Sterile urine	NDM
1951	Harrison	NDM	Clinical	5–7 days	NDM	NDM
1954	Nelson	NDM	Clinical	10 days	Sterile urine	Clinical
1954	Harrison	2 weeks	Clinical	10 days	NDM	NDM
1958	Harrison	NDM	Clinical	10 days	10 days	NDM
1959	Nelson	10 days	Clinical	10 days	Sterile urine	Clinical
1962	Harrison	Clinical	Clinical	10 days	NDM	NDM
1964	Nelson	10 days	Clinical	10 days	1 month	Clinical
1966	Harrison	Clinical	Clinical	10 days	10 days	NDM
1969	Nelson	7 days	NDM	10 days	2 weeks	10 days
1970	Harrison	Clinical	Clinical	10 days	10 days	NDM
1974	Harrison	Clinical	Clinical	10 days	NDM	NDM
1975	Nelson	Clinical	7 days	10 days	2 weeks	10 days
1977	Harrison	Clinical	Clinical	10 days	10 days	NDM
1979	Nelson	10 days	10 days	10 days	2 weeks	2 weeks

NDM indicates no duration mentioned.

*Pediatr Infect Dis J* 2017; 36:507

“Thou shalt treat for 14 days  
because yours is a lunar society;  
10 days  
Because yours is a decimal society;  
and 7 days  
because yours is an  
Old Testament society.”

Short-course antibiotic treatment of 4782  
culture-proven cases of group A  
streptococcal tonsillopharyngitis and  
incidence of poststreptococcal sequelae

- Adam D, Schotz H, Helmerking M
- *J Infect Dis* 2000;182:509-16
- Dr. V Hammersches Children's Hospital, Munich

### Group A streptococcus-2

- Methods
  - Multicenter, randomized, open-labeled, controlled study
  - Children with clinical tonsillopharyngitis
  - (+) rapid strep test confirmed by culture
  - Random (1:2 ratio): pen V for 10 days vs one of: amoxicillin/clavulanate, cefibuten, cefuroxime axetil, loracarbef, clarithromycin, erythromycin for 5 days

### Group A streptococcus-3

- 4782 study patients
- Conclusions
  - 5 days of amoxicillin, cephalosporin, or macrolide is equivalent to 10 days of penicillin for clinical response, streptococcal eradication, risk of recurrence
  - Poststreptococcal sequelae
    - Generally very low risk in developed countries regardless of treatment duration
    - But: ARF outbreak?; genetic risk?; developing countries?

### 5-day therapy for GAS pharyngitis

- Meta-analysis of 22 clinical trials involving 7470 patients
- ↑cure rates with 5 days oral 2nd or 3rd gen. cephalosporin vs 10 day penicillin
- Equivalent cure rates 6 days amoxicillin vs 10 days penicillin (small sample size)
- 5 days worse than 10 days penicillin
- *Pediatr Infect Dis J* 2005;24:909-917

### Streptococcal Pharyngitis Conclusions

- Test only for red throat (minimum) and better for high Centor score.
  - Accept that a positive streptococcal result may be a false positive.
- Antibiotics only for a positive test.
  - Give a prescription but do not fill until test result is available (deferred antibiotics).
  - Start antibiotics but stop if (-) test result.
- Use cephalosporin x 5 days.
- Never reculture (“strep phobia” prophylaxis)

## Acute otitis media

- When to suspect
- How to make the diagnosis
- How to treat

## “Does this child have acute otitis media?”

*JAMA* 2003;290:1633-1640

- Vanderbilt and Duke Universities
- Methods
  - English-language articles 1966-2002
  - Original data on precision or accuracy of findings used to diagnose AOM in children
  - Likelihood ratios calculated

## “Does this child have acute otitis media?”

- Results
  - 397 references initially identified
  - No studies used independent blind comparisons of findings in consecutive patients compared tympanocentesis
  - Only one article compared physical findings to tympanocentesis, but patients were not consecutive
    - Karma PH. *Int J Pediatr Otorhinolaryngol* 1989;17:37-49

## “Does this child have acute otitis media?”

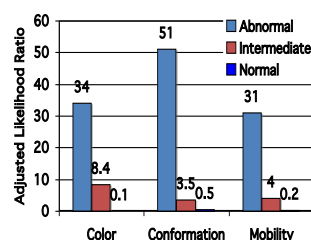
- Likelihood ratios of symptoms VERY modest (based on four studies of fair-poor design)
  - Ear pain: 3.0-7.3
  - Ear rubbing: 3.3
  - Excessive crying: 1.8
  - Fever: 0.8-2.6
  - Parental suspicion: 3.4

## “Does this child have acute otitis media?”

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## “Does this child have acute otitis media?”



- Color
  - Cloudy
  - Distinctly red
  - Normal
- Conformation
  - Bulging
  - Retracted
  - Normal
- Mobility
  - Impaired
  - Decreased
  - Normal

### Physical Examination for Otitis Media

- Roddey OF, Hoover HA, Earle R.
- Private Practice
- Charlotte NC and Weston MA
- Letter to the Editor
- *Pediatr Infect Dis J* 2003;22:673

### Physical Examination for OM-2

- In 112/113 myringotomies, fluid was present and under pressure when TM was bulging as determined by absence of bony landmarks (*JAMA* 1966;197:127-30)
- Single most important landmark is prominence (or lack thereof) of the short process of the malleus

### Physical Examination for OM-4

- “The practical measure of bulging is obliteration of the short process, the diagnostic role of which cannot be overemphasized”
  - Brennenman J. Otitis media as a pediatrician sees it. *JAMA* 1931;97:449
- We are disappointed that the current literature bias has not stressed [this sign]

### “Does this child have acute otitis media?”

#### Conclusions

- Symptoms are weak predictors of AOM
- The defining findings for AOM are a bulging tympanic membrane or visual loss of the short process of the malleus
- Pneumatic otoscopy useful as a tie-breaker in child with “distinctly red” TM
- Tympanometry or acoustic reflectometry infrequently necessary

### An evidenced based approach to reducing antibiotic use in children with acute otitis media: controlled before and after study

- Cates C.
- *BMJ* 1999;318:715-716.
- Manor View Practice, Bushey Health Centre, Bushey Hertfordshire, UK.

### Deferred antibiotics in AOM-2

#### Methods

- Change of office protocol
- AOM + “ill” child: antibiotics.
- AOM + “not particularly ill”:
  - Handout on limited benefit of antibiotics in AOM
  - Antibiotic prescription for parents to fill if child did not get better “over a day or two.”

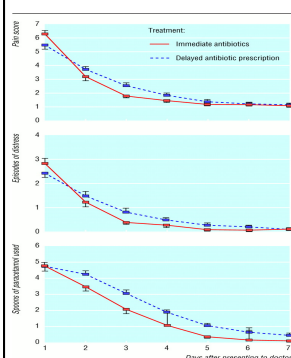
### Deferred antibiotics in AOM-3 Results

- Median monthly prescriptions for amoxicillin fell from 75 to 47.
- Prescriptions for all antibiotics fell by 19%.
- $\Delta$  AOM/Total antibiotics: 50% to 33%.

### Deferred antibiotics in AOM *BMJ* 2001;322:336-342

- Randomized controlled trial of immediate and delayed antibiotics in 315 children
- 93 general practices, SW England
- Age 6 mos - 10 years
- TM: dull or cloudy with redness, bulging, or perforation

### Deferred antibiotics-results



- 24% deferred group took antibiotics (usually by day 2)
- Effect of ABX group was ~ 1 days benefit
- No  $\Delta$  days school missed
- 77% deferred parents satisfied

### Deferred antibiotics in AOM *Pediatrics* 2005;115:1455-1465

- 223 children 6 m-12 y with “non-severe” AOM randomized to immediate antibiotics or “watchful waiting” (WW).
- “Severity” based on elaborate system
- Diagnosis of AOM standardized and supplemented by tympanography.
- “Failure” in WW: Rx = amoxicillin.
- Compliance measured (bottle weights).
- Outcome: symptom resolution (35 point scale) and recurrence rates (+others).

### Deferred antibiotics in AOM-2

- 34% WW given antibiotics
- Failure rate age was independent of treatment group.
- ABX group had  $\uparrow$  side-effects and  $\uparrow$  residual Pen-R pneumococcus
- 30 day otoscopic outcome identical
- Parent satisfaction identical

### Antibiotics for acute otitis media in children

*Cochrane Database of Systematic Reviews 2015, Issue 6. Art. No.: CD000219.*

- This review reveals that antibiotics have no early effect on pain, a slight effect on pain in the days following and only a modest effect on the number of children with tympanic perforations, contralateral otitis episodes and abnormal tympanometry findings at two to four weeks and at six to eight weeks compared with placebo in children with AOM. In high-income countries, most cases of AOM spontaneously remit without complications.

### Sample explanation

- Your child has an ear infection. It doesn't look too bad. You know, most of these ear infections get better on their own in 2-3 days. If you are willing, I would like to defer antibiotics for now. But, I'm going to give you a prescription for amoxicillin to take with you. If in 2-3 days, your child isn't better, then start the antibiotics and give me a call. I'm sure this will work fine, because . . . .
- you know your child best!*

### Short course antibiotics for acute otitis media

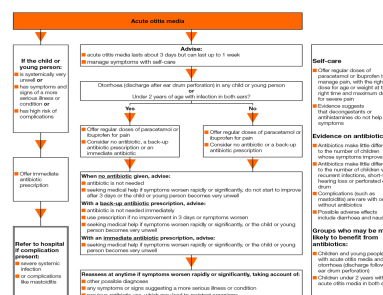
Cochrane Database of Systematic Reviews 2010, Issue 9. Art. No.: CD001095.

- This update included 49 trials containing 12,045 participants. Risk of treatment failure was minimally higher with short courses of antibiotics one month after initiation of therapy (21% failure with short-course treatment and 18% with long-course; absolute difference of 3% between groups).

### Acute Otitis Media The bottom line

- There are two kinds AOM: purulent AOM and routine AOM.
- Purulent AOM [UK = "ill"]
  - = Very bulging TM, bilateral disease, draining ear, "sick" child, very young age.
  - Full course antibiotics usual but deferred antibiotics reasonable.
- Routine AOM [UK: "not particularly ill"]
  - = Red, opaque, and/or mild-moderate bulging TM in "not particularly ill" child, unilateral disease.
  - Deferred antibiotics usual but short-course antibiotics reasonable.

### National Institute for Health and Care Excellence (NICE) AOM Guidelines <https://www.nice.org.uk/guidance/ng91>



### Urinary tract infection

- When to suspect
- How to make the diagnosis
- How to treat

### Development and validation of a calculator for estimating the probability of a UTI in infants 2-23 months (UTICalc)

- JAMA Pediatr 2018;172(6):550-556
- University of Pittsburgh
- <https://uticalc.pitt.edu/>

**UTICalc**  
For children 2 to 23 months of age.

Probability of UTI based on clinical characteristics

Enter child's clinical characteristics below (all fields are required)

Age < 12 months ☐ Yes ☐ No

Maximum temperature  $\geq 39^{\circ}\text{C}$  (i.e.,  $102.2^{\circ}\text{F}$ ) ☐ Yes ☐ No

Self describes race as black (fully or partially) ☐ Yes ☐ No

Female or uncircumcised male ☐ Yes ☐ No

Other fever source\* ☐ Yes ☐ No

Probability of UTI

Probability of UTI based on clinical characteristics

For children 2 to 23 months of age

Calculation Results

Please note: The pretest probability of UTI for your patient is relatively HIGH (i.e., greater than or equal to 2.0%). Many clinicians would obtain a urine sample in a patient with this probability.

Close

Probability of UTI 5.06%

\*Other fever source can include (but is not limited to): acute otitis media, upper respiratory tract infection (i.e., any cough or congestion), gastroenteritis, pneumonia, meningitis, bronchiolitis, and viral syndrome.

### A new technique for fast and safe collection of urine in newborns

- Fernandez MLF, Merino NG, Garcia AT et al.
- University Infanta Sofia Hospital, Madrid
- *Arch Dis Child* 2013;98:27-29

### Urine collection-2 Methods

- Prospective feasibility and safety study.
- Inclusion: infants  $\leq 1$  month who required a urine sample
- Technique: feed the baby; 25 min later, clean genitals; hold baby under armpits with legs dangling; rapid tapping on bladder for 30 sec; light circular massage of lumbar paravertebral zone for 30 sec; repeat until micturition

### Urine collection-3 Results

- 80 consecutive infants: 31 girls and 49 boys; mean age 6 days.
- 86% success rate
- Mean time for sample collection was 57 sec. No difference between genders.
- Controlled crying occurred in all babies

### Faster clean catch urine collection (Quick-Wee method) from infants: randomized controlled trial

- Kaufman J, Fitzpatrick P, Tosif S, et al.
- Royal Children's Hospital, Victoria, Australia
- *BMJ* 2017;357:1341



### Quick-Wee method-3 Methods-2

- Standard Clean Catch
  - Clean genital orifice for 10 seconds.
  - Wait 5 minutes for baby to urinate.
- Quick-Wee Method
  - Clean genital orifice for 10 seconds.
  - Rub suprapubic area in a circular pattern with gauze soaked in cold saline for up to 5 minutes.

### Quick-Wee method-5 Results-1

- N = 344.
- Male = 50%; female = 50%.
- 14% of babies had UTI ( $\geq 10^5$  cfu/ml).
- Voiding < 5 minutes
  - Quick-Wee = 31%.
  - Standard = 12%.
- Successful Catch
  - Quick-Wee = 96%
  - Standard = 75%

### Quick-Wee method-6 Results-2

- Contamination
  - Quick-Wee = 27%.
  - Standard = 45%.
- Satisfaction
  - Quick-Wee = “satisfied.”
  - Standard = “neutral.”

### Dipstick screening for urinary tract infection in febrile infants

- Glissmeyer EW, Korgenski EK, Wilkes J, et al
- University of Utah School of Medicine
- *Pediatrics* 2014;133:e1121-e1127

### Dipstick screening for UTI-1 Methods-1

- Retrospective observational study.
- 23 Intermountain Healthcare hospitals.
- Inclusion
  - Febrile infants aged 1-90 days; 2004-2011.
  - Catheterized urine specimens obtained.
- All had urine dipstick, microscopic UA, urine culture.

### Dipstick screening for UTI-2 Methods-2

- (+) UTI =  $\geq 1$  urine pathogen, each  $\geq 50,000$  cfu/ml.
- (-) UTI = <10,000 cfu/ml of organisms identified as skin or GU flora.
- (+/-) UTI = 10,000 – 49,999 cfu/ml of urine pathogen.
- Equivocal UTI were excluded from analysis.

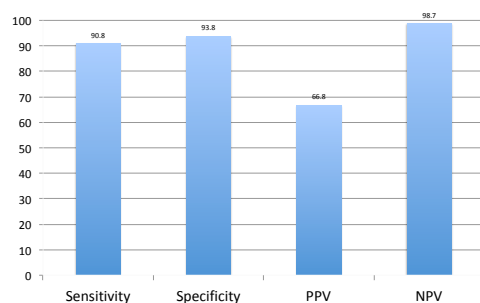
### Dipstick screening for UTI-3 Methods-3

- (+) Dipstick = either LE (+) or NIT (+). (+) = > "trace."
- (+) Micro = >10 WBC/hpf or any bacteria seen.
- Sensitivity, specificity, PPV, NPV were calculated for each of the UA results.

### Dipstick screening for UTI-4 Results-1

- 13,030 febrile infant encounters.
- 6536/13,030 (50%) had all urine studies
- After equivocal UCx excluded, 6394 enrolled infants were analyzed.
- 770/6394 (prevalence = 12%) had (+) UTI.

### Dipstick screening for UTI-5 Results-2

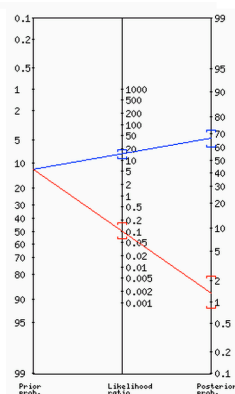
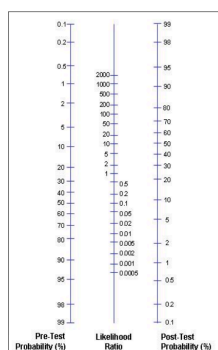


### Dipstick screening for UTI-6 Results-3

- Likelihood Ratios
  - (+) Dipstick = 14.6.
  - (-) Dipstick = 0.1.
- Urine microscopy did not add any meaningful accuracy to dipstick alone.
- False positive screens were higher with urine microscopy: 8 infants had false positive micro testing for every 1 infant with true UTI not identified by dipstick.

### Likelihood Ratio

- <http://araw.mede.uic.edu/cgi-bin/testcalc.pl>



### UTI in young infants discharged from the ED with normal UA

- Rivanowitch E, Nassar R, Kristal E, et al.
- Ben-Gurion University of the Negev
- *Acta Paediatrica* 2019;108:745-750

### UTI with normal UA-2

#### Methods-1

- Pediatric ED; 35,000 visits/year, 2500 below age 60 days.
- Retrospective cohort study.
- Inclusion
  - Age 0-90 days.
  - Normal UA and discharged home without treatment.
    - (-) UA = (-) LE and (-) nitrite.
  - UTI =  $> 10^5$  cfu/ml of uropathogen.

### UTI with normal UA-4

#### Results-1

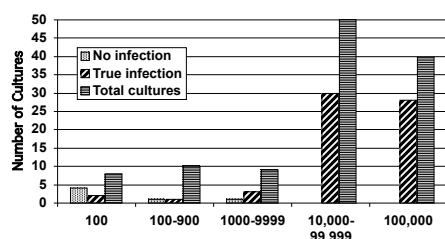
- 2004-2012, 26,231 infants < 90 days visited the ED. 7272 (28%) had a fever.
- Urine cultures obtained in 1957 (27%).
- 393/1957 (20%) UCx were positive.
- 46/393 (12%) had UTI + UA normal + discharged home.
  - 43% were 0-30 days.
  - 48% were 30-60 days.
  - 9% were 60-90 days.

### UTI with normal UA-5

#### Results-2

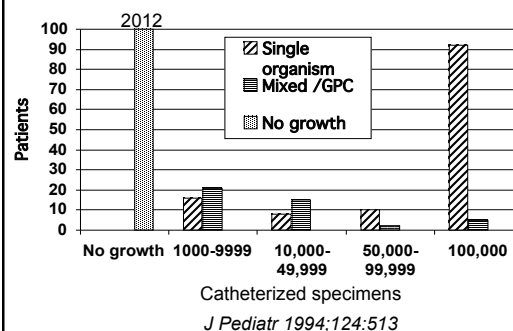
- Follow-Up visit (ED or community)
  - 11% had fever. 20% were irritable. 9% had diarrhea. 7% had vomiting.
  - All had a second normal UA.
  - On 2<sup>nd</sup> urine culture: 33% had (+) culture (73% < 30 days).
    - 50% were "ill. 50% were asymptomatic.
  - No infant had bacteremia, sepsis, or meningitis.

### Definition of true infection-1



"True infection" = 1st: SBT (+); 2nd: Cath/midstream (+)  
*Clin Pediatr* 1977;16:698

### Definition of true infection-2



Catheterized specimens  
*J Pediatr* 1994;124:513

### Oral antibiotics for pyelonephritis

*Pediatrics* 1999;104:79-86

- IV cefotaxime or oral cefixime on days 1-3 followed by oral cefixime in febrile UTI produce equivalent clinical and microbiological responses
- No risk of increased renal scarring
- No blood cultures if non-toxic
- Ditto for amox/clav: Antibiotic treatment for pyelonephritis in children: multicentre randomised controlled non-inferiority trial. *BMJ* 2007 Aug 25;335:386

### Oral versus initial intravenous therapy for urinary tract infections in young febrile children

- Children's Hospital of Pittsburgh
- Hoberman A, Wald ER, Hickey RW, et al.
- *Pediatrics* 1999;104:79-86

### Urinary tract infections-2

- Study design
  - Inclusion criteria
    - Children ages 1-24 months
    - Temperature (rectal)  $\geq 38.3^{\circ}\text{C}$
    - UA with  $\geq$  WBC/hpf and  $\geq 1$  gram neg rod/hpf
    - Culture positive  $\geq 50,000\text{cfu/ml}$  single pathogen from catheter specimen
  - Exclusion criteria
    - Gram positive cocci in urine
    - Severely ill child

### Urinary tract infections- 3

- Blood cultures in all patients
- Randomized
  - IV cefotaxime (200 mg/kg/d) x 3 days, then cefixime (8 mg/kg/d) to complete 14 days, or
  - Cefixime 16 mg/kg x 1 day; 8 mg/kg days 2-14
- Repeat exam + urine culture at 24 hours
- Imaging
  - DMSA renal scan at entry and at 6 months
  - Renal ultrasound at entry
  - VCUG at 4-5 weeks

### Urinary tract infections- 4

- Results
  - Total enrolled = 322
  - Urine sterile in all patients at 24 hours
  - Defervescence in both groups at 24 hours
  - 4% had bacteremia (8 IV, 5 PO)
    - Clinical appearance did not predict bacteremia
    - All had sterile blood cultures at 24 hours
  - Reinfection rates equal in both groups (5%-8%)

### Urinary tract infections- 5

- Acute pyelonephritis ( by DMSA) in 58%
- No difference: new renal scarring (7%-9%) or severity of scarring
  - Only VUR correlated with risk of scarring
- Cost of care/episode of febrile UTI
  - IV: \$7382
  - PO: \$3630

### Urinary tract infections- 6

- Conclusions
  - IV cefotaxime or oral cefixime on days 1-3 in febrile UTI produce equivalent clinical and microbiological responses
  - No risk of increased renal scarring when oral therapy for UTI is used
  - Blood cultures may not be necessary in non-toxic children
  - Follow-up urine culture not required

### Short vs long duration of antibiotics-1

- Systematic review of randomized, controlled trials
- 10 trials subjected to meta-analysis (no study < 2 days therapy)
- No significant difference in frequency of positive urine cultures at 7 or 10 days or later recurrence between short (2-4 days) and standard (7-10 days) therapy
- *Arch Dis Child* 2002;87:118-123

### Short vs long duration of antibiotics-2

- Meta-analysis: randomized, controlled trial
- 16 studies identified (11 used single dose therapy for “short-course”)
- Relative risk (RR) of treatment failure with short-course therapy was 1.94; for 5 studies using 3-day therapy as “short-course”, RR was 1.36 (95% CI: 0.46-2.13; not statistically significant)
- No differences in recurrence risk
- *Pediatrics* 2002;109(5):e70

### UTI: Short course therapy Conclusions

- Single-dose Rx has a significantly higher risk of bacteriologic failure (RR=2.73)
- 2-4 d equivalent to 7-10 d therapy
- Since 1-3% UTI fail after 7-14 days of therapy, 8000-10,000 children required to show a 33% difference in outcome
- This is all we know and likely to know
  - *Arch Dis Child* 2002;87:118-123. *Pediatrics* 2002;109(5):e70
  - See: *Arch Dis Child* 2003;88:89-91 for the debate in letters

### 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
- Roberts KB, Chair
- American Academy of Pediatrics
- *Pediatrics* 2011;128:595-610
- Technical Report: *Pediatrics* 2011;128:e749-770

### UTI-imaging Recommendations

- Febrile infants with UTIs should have renal and bladder ultrasonography (Evidence quality C)
- VCUG should not be performed routinely after 1<sup>st</sup> febrile UTI unless US study suggests high-grade reflux or obstruction. (Evidence quality B)
- Recurrent UTI: perform VCUG. (Evidence quality X)

Long-term antibiotics for preventing  
recurrent UTI in children

Cochrane Database of Systematic Reviews 2019, Issue  
4. Art. No.: CD001534. DOI:  
10.1002/14651858.CD001534.pub4.

- 16 studies (2036 children, 1977 analyzed)
- 1/16 was at low risk of bias.
- “Long-term antibiotics MAY reduce the risk of repeat symptomatic UTI in children who have had one or more previous UTIs but the benefit may be small and must be considered together with the increased risk of microbial resistance.”
-

## Acute otitis media

### If the child or young person:

- is systemically very unwell **or**
- has symptoms and signs of a more serious illness or condition **or**
- has high risk of complications

- Offer immediate antibiotic prescription

### Refer to hospital if complication present:

- severe systemic infection
- or complications like mastoiditis

### Advise:

- acute otitis media lasts about 3 days but can last up to 1 week
- manage symptoms with self-care

Otorrhoea (discharge after ear drum perforation) in any child or young person

or

Under 2 years of age with infection in both ears?

Yes

- Offer regular doses of paracetamol or ibuprofen for pain
- Consider no antibiotic, a back-up antibiotic prescription or an immediate antibiotic

No

- Offer regular doses of paracetamol or ibuprofen for pain
- Consider no antibiotic or a back-up antibiotic prescription

### When no antibiotic given, advise:

- antibiotic is not needed
- seeking medical help if symptoms worsen rapidly or significantly, do not start to improve after 3 days or the child or young person becomes very unwell

### With a back-up antibiotic prescription, advise:

- antibiotic is not needed immediately
- use prescription if no improvement in 3 days or symptoms worsen
- seeking medical help if symptoms worsen rapidly or significantly, or the child or young person becomes very unwell

### With an immediate antibiotic prescription, advise:

- seeking medical help if symptoms worsen rapidly or significantly, or the child or young person becomes very unwell

### Reassess at anytime if symptoms worsen rapidly or significantly, taking account of:

- other possible diagnoses
- any symptoms or signs suggesting a more serious illness or condition
- previous antibiotic use, which may lead to resistant organisms

### Self-care

- Offer regular doses of paracetamol or ibuprofen to manage pain, with the right dose for age or weight at the right time and maximum doses for severe pain

- Evidence suggests that decongestants or antihistamines do not help symptoms

### Evidence on antibiotics

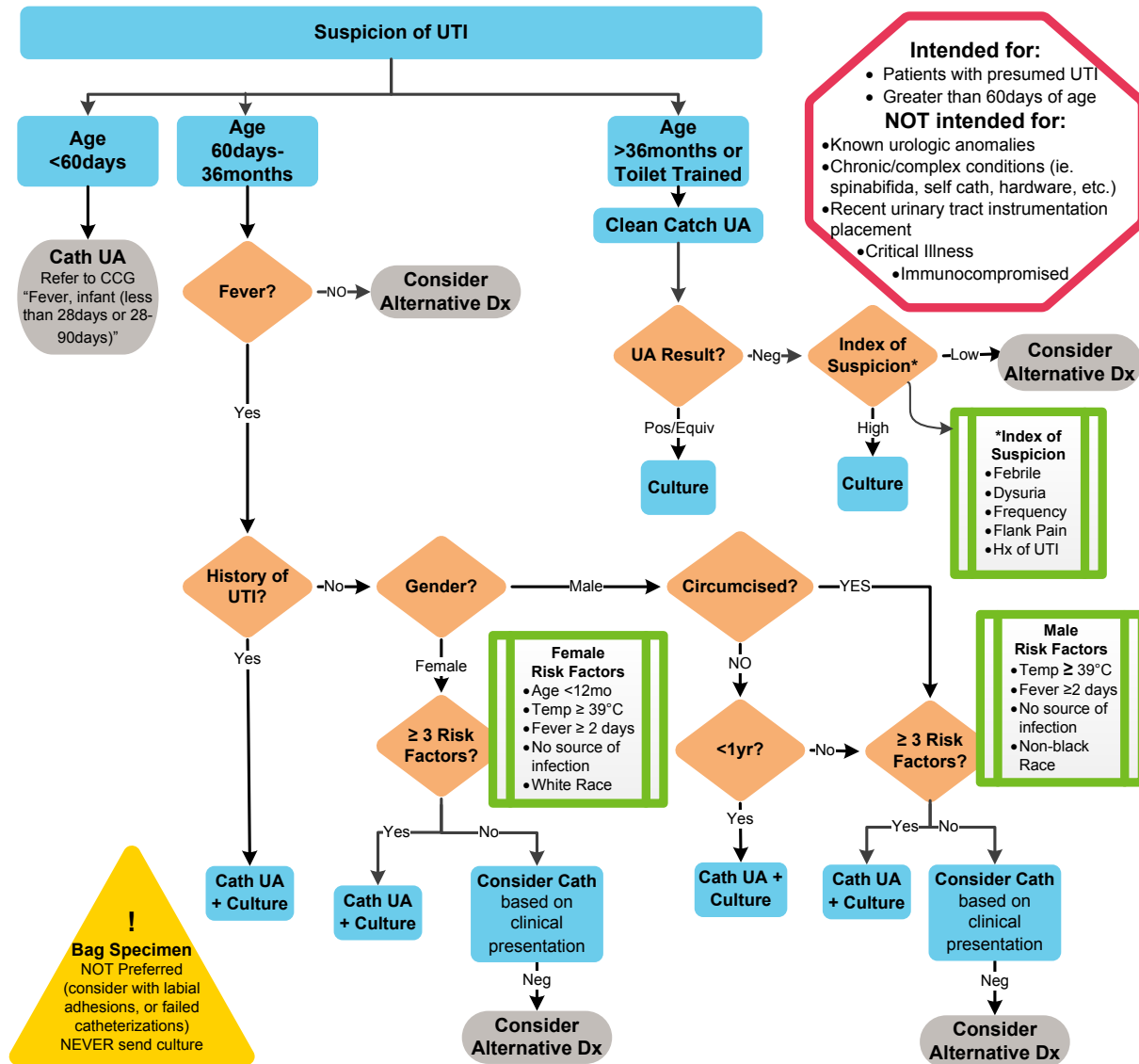
- Antibiotics make little difference to the number of children whose symptoms improve
- Antibiotics make little difference to the number of children with recurrent infections, short-term hearing loss or perforated ear drum
- Complications (such as mastoiditis) are rare with or without antibiotics
- Possible adverse effects include diarrhoea and nausea

### Groups who may be more likely to benefit from antibiotics:

- Children and young people with acute otitis media and otorrhoea (discharge following ear drum perforation)
- Children under 2 years with acute otitis media in both ears

# URINARY TRACT INFECTION (UTI)

## ALGORITHM- UTI Testing



### Imaging Recommendations for patients >2months after 1<sup>st</sup> Febrile UTI

#### No imaging required

- o Prompt response to therapy (afebrile in 72 hrs)
- o Reliable outpatient follow up
- o Normal voiding pattern
- o No abdominal mass
- o Normal (≤5mm pelvic dilation) 3<sup>rd</sup> trimester (>28 week) prenatal ultrasound

#### Consider Renal Ultrasound:

- o At clinical discretion in patient under 2 years
- o Bowel/bladder dysfunction

#### Renal Ultrasound recommended

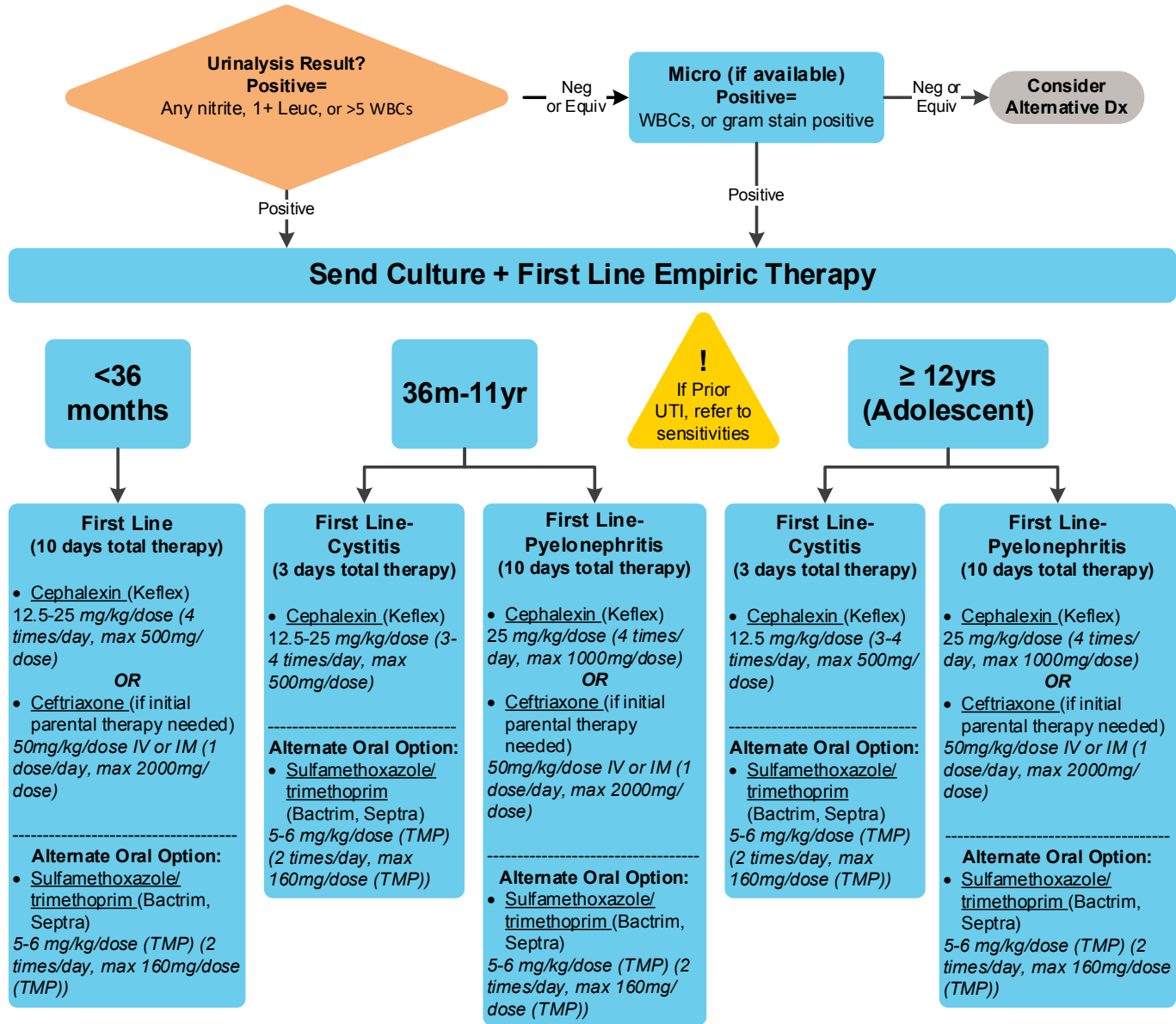
- o Patient does not have adequate clinical response to appropriate treatment
- o Urosepsis/Severe infection associated with UTI
- o Recurrent UTIs
- o Unusual pathogens
- o Hypertension

#### Strongly consider Voiding Cystourethrogram (VCUG)

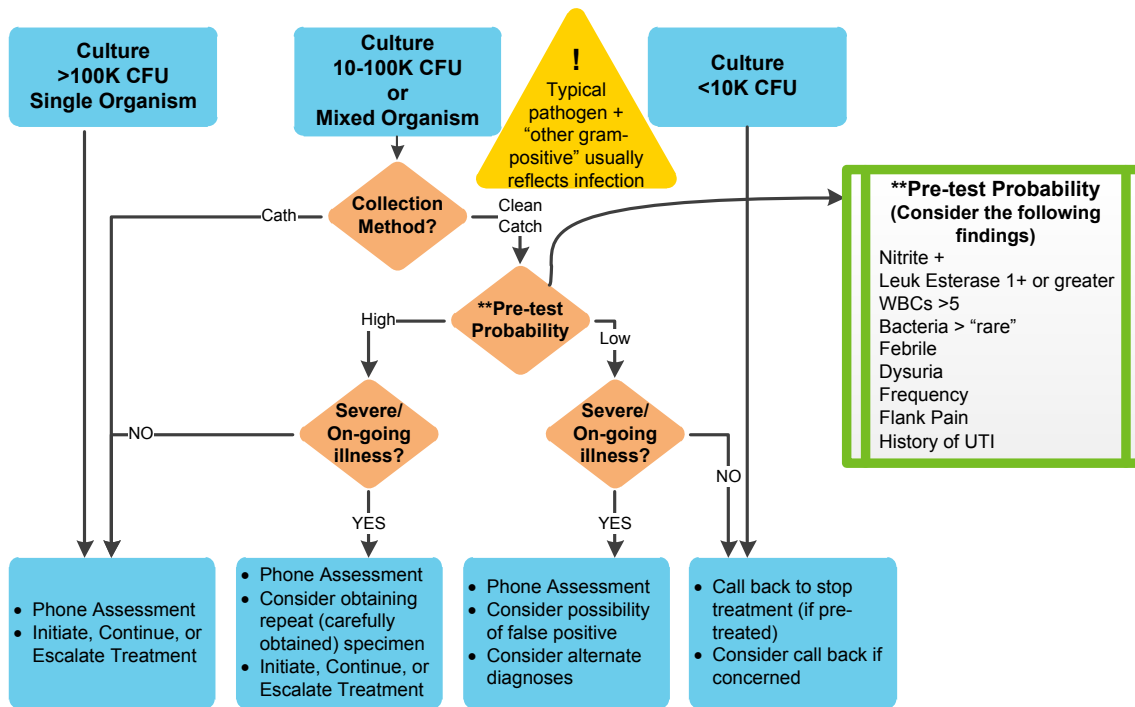
- o Renal U/S reveals hydronephrosis, scars, or findings of high grade VUR or obstructive uropathy
- o Urosepsis/Severe infection associated with UTI (postpone until infection has cleared)
- o Recurrent UTIs (especially if family hx)



ALGORITHM- UTI Empiric Therapy

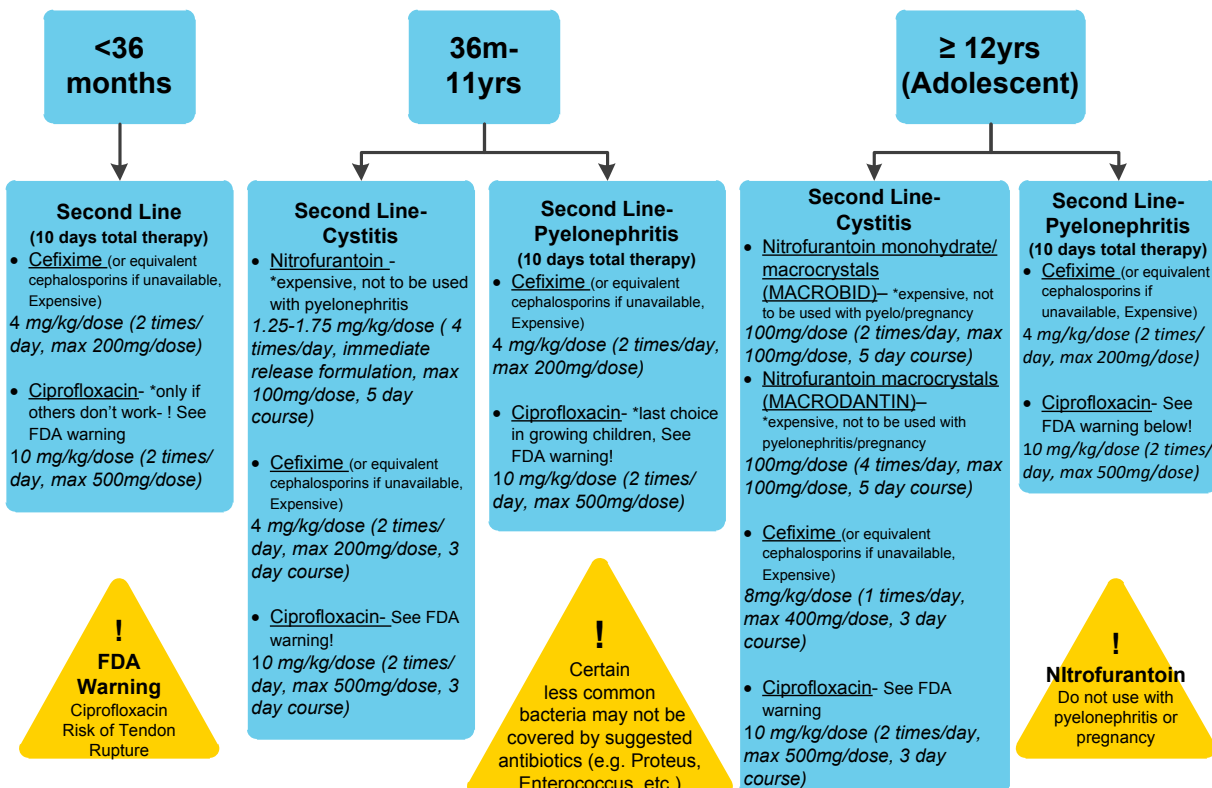


## ALGORITHM- UTI Culture Results



## Second Line Therapy

If resistant, phone follow-up is warranted. If patient is not improving, change to susceptible antimicrobial



## TABLE OF CONTENTS

[Algorithm – UTI Testing](#)

[Algorithm – UTI Empiric Therapy](#)

[Algorithm – UTI Culture Results](#)

[Target Population](#)

[Background](#)

[Initial Evaluation](#)

[Clinical Management](#)

[Laboratory Studies | Imaging](#)

[Therapeutics](#)

[References](#)

[Clinical Improvement Team](#)

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## TARGET POPULATION

### Inclusion Criteria

- Patients with presumed or documented UTI
- Patients aged >60 days old

### Exclusion Criteria

- Need for immediate critical care/toxicity
- Known urologic anomalies
- Chronic/Complex conditions (ex. Spinabifida, self-cath, hardware, etc.)
- Immunocompromised

## BACKGROUND

- UTIs are the most common cause of serious bacterial illness in children
- Recurrent UTI is a known cause chronic kidney disease in children
- Inappropriate management may result in severe or invasive illness
- Knowledge of risk factors and appropriate testing and interpretation of the results in proper clinical context is necessary for accurate diagnosis and treatment of UTI

## Probability of UTI based on Number of Risk Factors

# Risk Factors	Males		Females
	Uncircumcised	Circumcised	
0	2.1%	0.2%	3.3%
1	4.1%	0.5%	5.1%
2	7.9%	1.0%	6.5%
3	14.7%	1.9%	11.4%
4	25.9%	3.7%	33.0%
5	--	--	45.0%

### Male Risk Factors

- Temp  $\geq 39^{\circ}\text{C}$
- Fever  $\geq 2$  days
- No source of infection
- Non-black Race

### Female Risk Factors

- Age <12mo
- Temp  $\geq 39^{\circ}\text{C}$
- Fever  $\geq 2$  days
- No source of infection
- White Race

## INITIAL EVALUATION

### Signs and Symptoms<sup>1</sup>

Age group		Symptoms and signs Most common —————> Least common		
Infants younger than 3 months		Fever Vomiting Lethargy Irritability	Poor feeding Failure to thrive	Abdominal pain Jaundice Haematuria Offensive urine
Infants and children, 3 months or older	Preverbal	Fever	Abdominal pain Loin tenderness Vomiting Poor feeding	Lethargy Irritability Haematuria Offensive urine Failure to thrive
	Verbal	Frequency Dysuria	Dysfunctional voiding Changes to continence Abdominal pain Loin tenderness	Fever Malaise Vomiting Haematuria Offensive urine Cloudy urine

## CLINICAL MANAGEMENT

Consider Urology Consult

- Urologic anomalies
- Recurrent UTI unresponsive to routine preventative measures
- Any questions or concerns regarding imaging, management, or prophylaxis

## LABORATORY STUDIES | IMAGING

### Laboratory Studies

#### Urinalysis (UA)

- Dipstick<sup>2, 3</sup> or Standard

Table 2. Urinalysis Methods

	Dipstick	Microscopic
<b>Mechanism</b>	Dipstick	Centrifuge, No Gram stain
<b>Pyuria</b>	Leukocyte esterase: suggestive of UTI but not diagnostic	Equal to or greater than 5 WBC/HPF
<b>Bacteriuria</b>	Nitrite: highly specific but negative test not reliable *concentrated/first morning void specimens might make it more likely to observe nitrites when infection is present	Any bacteria\HPF (but correlates poorly with Gram stain and culture)
<b>Sensitivity</b>	Moderate- 88%, but not specific	Low - less than 81 %

### Urine Culture (UC)

- Gold standard for diagnosis of UTI
- Most definitive result is >100,000 cfu of a single uropathogen
- CHCO lab does not report colony counts above or below 50,000 (only 10,000 or 100,000)
- However, multiple organisms and lower colony counts can reflect true UTI, particularly if:
  - The culture comes from a catheter specimen
  - There is high pre-test probability of UTI based on clinical history and urinalysis results (particularly if urine was nitrite positive)
  - One organism is a typical/common pathogen, e.g. *E.coli* and second organism is “other gram positive”
  - The patient has urinary tract anomalies
- Organisms considered contaminants (See [Table 5. Microorganisms Associated with UTI](#))
- Voided specimens can lead to false positive urine cultures. This is particularly true when there is low pre-test probability. When illness is severe or higher risk (e.g. in infancy), or an alternate diagnosis is more likely, a catheter specimen will lead to more reliable final culture results unless the urine is known to be nitrite positive.
- Test of cure/repeat urine cultures are not needed if responsive to therapy <sup>4,5</sup>

Table 4. *Microorganisms Associated with UTI at Children's Hospital Colorado*

Frequency of organisms in urine culture by collection method at CHCO June 1, 2013 and May 31, 2015. Note frequency of “other gram positive” in cultures with multiple organisms. The vast majority of these cultures from catheter specimens also contain a typical uropathogen. Thus a typical pathogen (e.g. *E. coli*) plus “other gram positive” should be considered a positive culture for the pathogen, rather than a contaminated/unreliable specimen.

Organism	Catheter		Clean Catch	
	1 organism (% total)	% present in isolates with multiple organisms	1 organism (% total)	% present in isolates with multiple organisms
<i>Escherichia coli</i>	570 (66.28)	14.3%	814 (48.74)	3.1%
Other gram-positive	86 (10.00)	76.2%	592 (35.45)	92.3%
Other gram-negative rods	63 (7.33)	2.4%	75 (4.49)	1.9%
Other gram-negative enteric	42 (4.88)	2.4%	35 (2.10)	0.8%
<i>Enterococcus</i>	42 (4.88)	4.2%	20 (1.20)	0.2%
<i>Proteus</i>	22 (2.56)	0.6%	39 (2.34)	0.4%
<i>Staphylococcus</i>	19 (2.21)	0.00%	60 (3.59)	1.3%
<i>Streptococcus</i>	13 (1.51)	0.00%	31 (1.86)	0.00%
Other	3 (0.35)	0.00%	4 (0.24)	0.00%

Table 5. *Microorganisms Associated with UTI*

Gram-negative Organisms	Gram-positive Organisms	Fungal	Other organisms considered contaminants
<i>Escherichia coli</i> (most common, more than 80% first UTI)	<i>Enterococci</i>	<i>Candida</i> (usually in premature infants)	"Other Gram Positives" <i>Lactobacillus</i>
<i>Klebsiella</i> (next most common organism)	<i>Staphylococcus saprophyticus</i> (& others)		<i>Corynebacteria</i>
<i>Proteus</i>	<i>Staphylococcus aureus</i>		<i>Micrococcus</i> species
<i>Pseudomonas</i> (less than 2%)	Group B streptococci		<i>Diphtheroids</i>
<i>Enterobacter</i> (less than 2%)			<i>Bacillus</i>

#### Additional laboratory studies to consider based on clinical presentation

- Serum chemistries
  - BMP if concerns for renal involvement
- CBC, ESR, CRP are not routinely indicated
- Blood culture is not routinely indicated unless concern for bacteremia

## Imaging

#### Imaging studies for identifying structure

- Renal Ultrasound<sup>26</sup>
  - Non-invasive study dependent on examiner skill
  - Demonstrates anatomy of bladder, ureters, kidneys including renal size, and obstruction
  - No evaluation of renal function
  - Not adequate for assessment VUR
- CT Scan/ MRI
  - With IV contrast, useful in evaluation of renal parenchyma (both active infection and renal scarring). There is limited value in split renal function.
  - Useful in perinephric pathology
  - Useful in defining the degree and level of obstruction

- CT poses the potential risk associated with ionizing radiation and risk from contrast on the kidneys
- MRI often requires sedation in young children

### Imaging studies for identifying VUR <sup>27</sup>

- Voiding cystourethrogram (VCUG)
  - Optimal initial study to demonstrate anatomy of lower tract disease (e.g. valves), and evaluate and grade VUR (postpone until infection has resolved).

### Imaging studies for identifying scarring

- CT, MRI, or DMSA (only if indicated by urology)- should only be ordered in consultation with urology

## THERAPEUTICS

### Antibiotics

- See algorithm for recommendations
- Please note Amoxicillin/clavulanate (Augmentin) and Amoxicillin are not recommended antibiotics for UTI treatment based on CHCO sensitivity data.
- If Cefixime is unavailable, alternative options would be cefpodoxime, cefuroxime, cefprozil, etc.

### Analgesics

- Acetaminophen for comfort
- Ibuprofen or other NSAIDS should be used with caution if concern for renal injury
- Phenazopyridine for symptoms of dysuria for patients 6 years and older age. Educate families on urine discoloration when taking this drug.

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Antimicrobial Stewardship Committee – March 2017

Clinical Care Guideline and Measures Review Committee – March 20, 2017

Pharmacy & Therapeutics Committee – April 6, 2017

<b>MANUAL/DEPARTMENT</b>	Clinical Care Guidelines/Quality
<b>ORIGINATION DATE</b>	December 12, 2011
<b>LAST DATE OF REVIEW OR REVISION</b>	April 6, 2017
<b>APPROVED BY</b>	 <b>Lalit Bajaj, MD, MPH</b> Medical Director, Clinical Effectiveness

## REVIEW | REVISION SCHEDULE

Scheduled for full review on April 6, 2021

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