Clinical Pathways

Urinary Tract Infection

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Connecticut Children's

MAGNET RECOGNIZED AMERICAN NURSES CREDENTIALING CENTER

BEST CHILDREN'S HOSPITAL WOMEN'S CHOICE AWARD 2023

What is a Clinical Pathway?

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An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.

Objectives of Pathway

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- Decrease the variation in method of urine collection
- Improve accurate diagnosis of UTI using specific lab criteria
- Improve the use of appropriate antibiotic therapy in the inpatient and outpatient settings
- Standardize the use of renal bladder ultrasound for 1st time UTI
- Decrease use of voiding cysto-urethrogram (VCUG) as a first line imaging tool
- Outline appropriate follow up

Why is Pathway Necessary?

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- It is the most common cause of serious bacterial infection in young infants
- Provides an evidence-based guideline that decreases unnecessary variations in collecting specimens, initiating antibiotics, and ordering imaging to help promote safe, effective, and consistent patient care
- New practice guidelines from the AAP for children ages 2-24 months released in 2011 and AAP reaffirmation of the guidelines in 2016
- For older children, the pathway is based on best practices and recommendations from CT Children's Emergency Department, Infectious Diseases, Nephrology, and Urology experts

Background

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- UTI is a bacterial infection of kidneys, ureters, bladder and/or urethra.
- Common etiologies include: *Escherichia coli* (most common); *Klebsiella, Proteus, Enterococcus,* and *Enterobacter* species
- Risk factors that are associated with a UTI include:
  - Males:
    - Uncircumcised <1 year old
    - All <6 months old
    - Temperature >39°
    - Fever <24 hours
    - Absence of another source of infection
  - Females:
    - All <12 months old
    - Temperature >39°
    - Fever >2 days
    - Absence of another source of infection

Signs and Symptoms

- Signs and symptoms can include:
  - Nonspecific symptoms (e.g., fever, irritability)
  - Abdominal symptoms (e.g., pain, vomiting)
  - Back pain
  - Dysuria, frequency, urgency
  - New-onset urinary incontinence

Goals for Appropriate Treatment of UTI

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- Elimination of UTI and prevention of acute complications (e.g., bacteremia)
- Prevention of recurrence and long term complications including hypertension, renal scarring, and impaired renal growth and function
- Relief of acute symptoms including fever, dysuria, and frequency

Imaging Goal

- To identify patients most susceptible to renal damage due to abnormalities such as obstructive uropathies, dilating Vesico-Ureteral Reflux (VUR), and other anomalies.
  - Scarring from repeated infections of the renal parenchyma leads to hypertension in 10-20% of patients
  - The risk for damage increases with every infection

Prophylaxis

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- AAP Practice guideline does not recommend routine use of prophylactic antimicrobials following first febrile UTI

This is the Urinary Tract Infection Clinical Pathway.

We will be reviewing each component in the following slides.

CLINICAL PATHWAY:

Urinary Tract Infection (UTI)

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Factors associated with UTI:

Males
- Uncircumcised <1 year old
- All <6 months old
- Temp >39° C
- Fever >24hrs
- Absence of another source of infection

Females
- All <12 months old
- Temp >39°C
- Fever >2 days
- Absence of another source of infection

[1]Considerations for sexually active females:
- *If lower abdominal/pelvic pain*: consider bimanual exam to evaluate for PID.
- *If abnormal vaginal discharge*: test for yeast, BV, trichomonas

Inclusion Criteria: ≥2 months old with 1st or 2nd urinary tract infection (UTI)
Exclusion Criteria: <2 months old, past documented >2 UTI or pyelonephritis, pre-existing GU/Nephro abnormalities, concern for sepsis (see Septic Shock Clinical Pathway)

Initial Work Up:
- *If 2mo-24mo or non-toilet trained*:
  - Obtain urinalysis (U/A) **and** culture via suprapubic aspiration (SPA) or catheterization (cath)
  - If any voided specimen is positive (LE/nitrite/bacteria/pyuria): obtain a cath specimen for U/A, culture
- *If toilet trained/non sexually active adolescent*: Obtain mid stream clean catch U/A and culture
- *If sexually active adolescent*[1]: Obtain dirty urine for GC/Chlamydia, mid stream clean catch U/A, culture, urine hCG

If suspected UTI based on clinical picture **or** presumed UTI (U/A with positive leukocyte esterase or nitrates, and/or >5 WBC and bacteria)

Meets Admission Criteria?
Requires IV antibiotics; immunocompromised; vomiting/unable to tolerate oral medication; lack of adequate follow-up

Yes →

Antibiotics:
Obtain U/A and culture before starting antibiotics.
Review past culture results for potential resistances.
- Start empiric treatment with **Ceftriaxone IV**
  - 2-24 months old: 50 mg/kg/dose q24hr (max 1 g/day)
  - >24 months old: 50 mg/kg/dose q24hr (max 2 g/day)

Work-Up and Consults:
- iStat chem 10, if not done
  - If abnormal, send chem 10 to lab
- Call Nephrology if acute kidney injury (AKI)[2]

Definite UTI
(+U/A and +culture)?
Positive urine culture =
SPA >100 cfu/ml ***OR***
Clean catch: >10,000-100,000 cfu/ml of a single organism ***OR***
Cath: >10,000 cfu/ml

No → Discontinue antibiotics and consider other sources of fever. Consider discussing with Infectious Diseases.

Yes →

Antibiotics:
- *If urine culture grows enterococcus*: change to ampicillin IV 100 mg/kg/day div q6hr (max 4 g/day)
- Adjust antibiotics according to sensitivities of organism and transition to PO once clinically improving (e.g., improved fever curve, tolerating PO, pain improvement)
  - If organism is not susceptible to cefazolin, do not prescribe oral cephalosporins. Discuss with ID if questions.
- Duration of treatment:
  - Cystitis (e.g., dysuria, frequency, urgency): 3 days; mild pyelonephritis (e.g., urinary s/s *and* fever and/or flank pain) with rapid response to antibiotics: 7 days; severe pyelonephritis with delayed response to antibiotics: 10 days; pyelonephritis complicated by intrarenal or perinephric abscess: at least 14 days as directed by ID
- ID consult for: UTI likely but culture >1 organism, drug resistant organisms, UTI with bacteremia, severe pyelonephritis with delayed response to antibiotics, pyelonephritis complicated by intrarenal or perinephric abscess

Order Renal Bladder Ultrasound (RBUS) for:
- All boys
- Girls 2-24 months
- Girls >24 months: provider discretion based on behavioral history such as toileting issues, constipation, and bladder dysfunction
- Previously abnormal RBUS
- Seriously ill, poor urine flow, elevated creatinine, urine culture positive for *Candida* or *Staphylococcus aureus*

If RBUS is anatomically abnormal, strongly consider VCUG while on current therapeutic antibiotics toward end of antibiotic course, and Nephrology and/or Urology consult.
If 2nd UTI with normal RBUS, can discuss further imaging with specialist.

Consider: Treating any bowel/bladder dysfunction (i.e. constipation)

Discharge Criteria
Clinical improvement (down-trending fevers, down-trending CRP if following); adequate PO without need for IVFs; tolerating PO antibiotics; parent capable of caring for child at home; parental education complete; imaging studies completed or scheduled as outpatient; PCP and/or subspecialty follow-up scheduled

No →

OUTPATIENT TREATMENT
U/A and culture should be obtained prior to starting antibiotics.
Review past culture results for potential resistance patterns.
If history of UTI with resistance, treat off pathway.

Antibiotics:
- **Cephalexin** PO 50 mg/kg/day div TID
(If concern for pyelonephritis: 100 mg/kg/day div TID-QID, max 4 g/day. MIC should be ≤2 for cefazolin. If MIC >2, discuss w/ID.)
- *If PCN allergy:*
  - **Bactrim** 8 mg TMP/kg/day PO divided BID (max: 160 mg TMP single dose) or
  - **Nitrofurantoin** *(only for use in simple cystitis)* 5-7 mg/kg/day divided q6hr PO (max 400 mg/day)
- *If sexually active female with cystitis*:
  - Nitrofurantoin 100 mg BID x5-7 days or Bactrim DS BID x3 days (for *Staph. saprophyticus*). If concern for pyelonephritis: consider Ciprofloxacin or Levofloxacin
- Duration of treatment:
  - Cystitis (e.g., dysuria, frequency, urgency): 3 days (up to 5-7 if sexually active female on nitrofurantoin)
  - Mild pyelonephritis (e.g., urinary s/s *and* fever and/or flank pain): 7 days

Imaging:
- Renal bladder ultrasound if indicated:
  - All boys; all patients 2-24 months 1st or 2nd UTI; previously abnormal RBUS; urine culture positive for *Candida* or *Staphylococcus aureus*
  - Girls >24 months: provider discretion based on behavioral history such as toileting issues, constipation, and bladder dysfunction
- Consider VCUG if previous or current RBUS is abnormal (e.g., hydronephrosis, scarring, structural abnormalities) while on current therapeutic antibiotics toward end of antibiotic course

Follow Up:
- Urine culture for speciation. If enterococcus grows, change to amoxicillin 50 mg/kg/day div TID.
- Follow up sensitivities and adjust antibiotics if needed
- Schedule follow-up w/PCP
- If imaging abnormal, consider follow-up with Nephrology and/or Urology
- Follow up with ID if multidrug resistant pathogen

[2]Consider Acute Kidney Injury (AKI) based on the following criteria:
- Increase in serum creatinine by 1.5-1.9 times baseline within the prior seven days, or
- Increase in serum creatinine by ≥0.3 mg/dL from baseline (≥26.5 mcmol/L) within 48 hours, or
- For those with unknown creatinine, an eGFR <90 ml/min/1.73m^2

CONTACTS: MARTA NEUBAUER, MD | KARA DENZ FLUCK, PA

LAST UPDATED: 05.17.24

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CLINICAL PATHWAY:

Urinary Tract Infection (UTI)

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

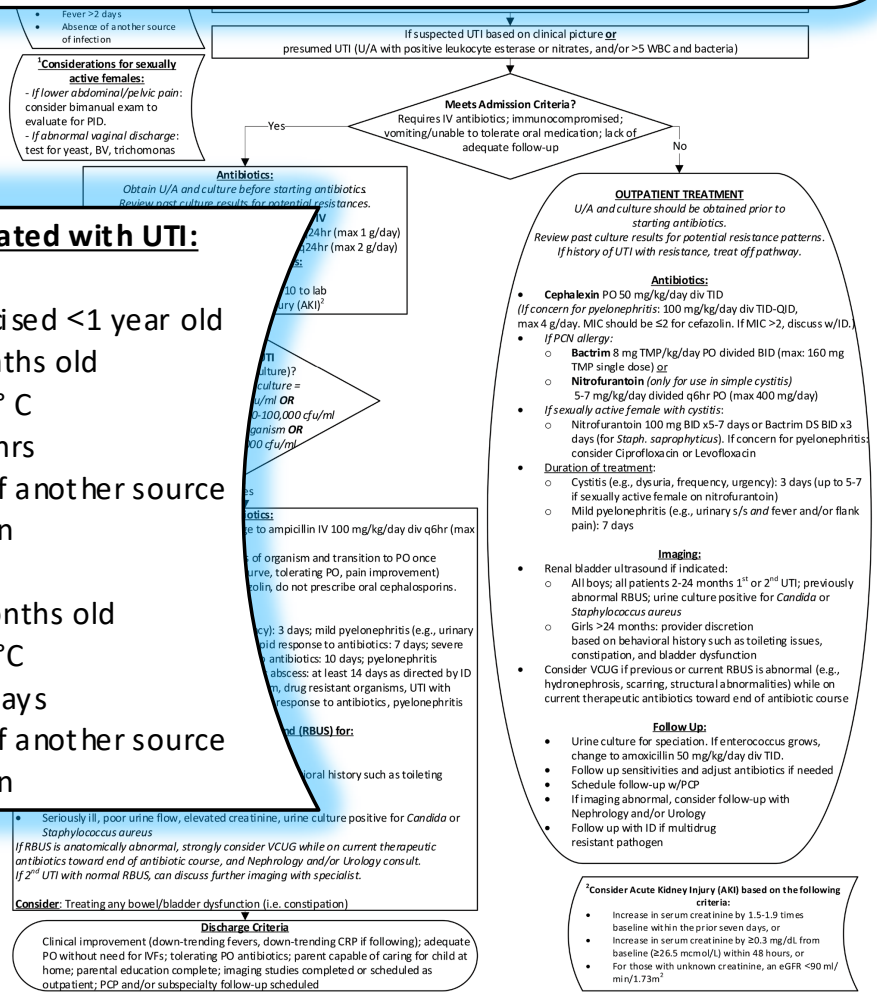
Inclusion Criteria: ≥2 months old with 1st or 2nd urinary tract infection (UTI)
Exclusion Criteria: <2 months old, past documented >2 UTI or pyelonephritis, pre-existing GU/Nephro abnormalities, concern for sepsis (see **Septic Shock Clinical Pathway**)

Inclusion Criteria:

- ≥2 months old with 1st or 2nd UTI
- Those with >2 previously documented UTI or pyelonephritis, pre-existing GU/nephron abnormalities, or concern for sepsis, should be excluded from the pathway.

Risk factors for UTI vary depending on gender

- Note: In support of the AAP's action to remove race-based medicine, CT Children's has removed race-based risk factors from this guideline



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Initial Work Up:

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  - If any voided specimen is positive (LE/nitrite/bacteria/pyuria): obtain a cath specimen for U/A, culture
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Obtain U/A and culture before starting antibiotics.
Review past culture results for potential resistances.
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Work-Up and Consults:
- iStat chem 10, if not done
  - If abnormal, send chem 10 to lab
- Call Nephrology if acute kidney injury (AKI)[2]

Definite UTI
(+U/A and +culture)?
Positive urine culture =
SPA >100 cfu/ml ***OR***
Clean catch: >10,000-100,000 cfu/ml of a single organism ***OR***
Cath: >10,000 cfu/ml

No → Discontinue antibiotics and consider other sources of fever. Consider discussing with Infectious Diseases.

Yes ↓

Antibiotics:
- *If urine culture grows enterococcus*: change to ampicillin IV 100 mg/kg/day div q6hr (max 4 g/day)
- Adjust antibiotics according to sensitivities of organism and transition to PO once clinically improving (e.g., improved fever curve, tolerating PO, pain improvement)
  - If organism is not susceptible to cefazolin, do not prescribe oral cephalosporins. Discuss with ID if questions.
- Duration of treatment:
  - Cystitis (e.g., dysuria, frequency, urgency): 3 days; mild pyelonephritis (e.g., urinary s/s *and* fever and/or flank pain) with rapid response to antibiotics: 7 days; severe pyelonephritis with delayed response to antibiotics: 10 days; pyelonephritis complicated by intrarenal or perinephric abscess: at least 14 days as directed by ID
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- Previously abnormal RBUS
- Seriously ill, poor urine flow, elevated creatinine, urine culture positive for *Candida* or *Staphylococcus aureus*

If RBUS is anatomically abnormal, strongly consider VCUG while on current therapeutic antibiotics toward end of antibiotic course, and Nephrology and/or Urology consult.
If 2nd UTI with normal RBUS, can discuss further imaging with specialist.

Consider: Treating any bowel/bladder dysfunction (i.e. constipation)

Discharge Criteria
Clinical improvement (down-trending fevers, down-trending CRP if following); adequate PO without need for IVFs; tolerating PO antibiotics; parent capable of caring for child at home; parental education complete; imaging studies completed or scheduled as outpatient; PCP and/or subspecialty follow-up scheduled

OUTPATIENT TREATMENT
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If history of UTI with resistance, treat off pathway.

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- *If PCN allergy:*
  - **Bactrim** 8 mg TMP/kg/day PO divided BID (max: 160 mg TMP single dose) or
  - **Nitrofurantoin** *(only for use in simple cystitis)* 5-7 mg/kg/day divided q6hr PO (max 400 mg/day)
- *If sexually active female with cystitis*:
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- Duration of treatment:
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  - Mild pyelonephritis (e.g., urinary s/s *and* fever and/or flank pain): 7 days

Imaging:
- Renal bladder ultrasound if indicated:
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- Consider VCUG if previous or current RBUS is abnormal (e.g., hydronephrosis, scarring, structural abnormalities) while on current therapeutic antibiotics toward end of antibiotic course

Follow Up:
- Urine culture for speciation. If enterococcus grows, change to amoxicillin 50 mg/kg/day div TID.
- Follow up sensitivities and adjust antibiotics if needed
- Schedule follow-up w/PCP
- If imaging abnormal, consider follow-up with Nephrology and/or Urology
- Follow up with ID if multidrug resistant pathogen

[2]**Consider Acute Kidney Injury (AKI) based on the following criteria:**
- Increase in serum creatinine by 1.5-1.9 times baseline within the prior seven days, or
- Increase in serum creatinine by ≥0.3 mg/dL from baseline (≥26.5 mcmol/L) within 48 hours, or
- For those with unknown creatinine, an eGFR <90 ml/min/1.73m^2

Specimen collection:

- If 2- 24mo old or non-toilet trained:
  - Obtain Suprapubic Catheterization (SPA) or catheterization (Cath) U/A and culture
- If toilet trained/non sexually active adolescent:
  - Clean catch U/A and culture
- If sexually active adolescent:
  - Dirty urine for GC/Chlamydia, clean catch U/A, culture, urine hCG
  - Consider other testing as indicated

Specimen collection should occur prior to antibiotic administration, unless there is concern for sepsis

[1]Considerations for sexually active females:

- *If lower abdominal/pelvic pain*: consider bimanual exam to evaluate for PID.
- *If abnormal vaginal discharge*: test for yeast, BV, trichomonas

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A UTI is suspected based on the patient's overall clinical picture, or if there is a U/A with positive leukocyte esterase or nitrates, and/or >5 WBC and bacteria.

Management then depends on if the patient meets admission criteria.

- Most children older than 2 months can be safely managed as outpatients as long as they have good compliance & close follow up

Factors associated with UTI:

Males

- Uncircumcised <1 year old
- All <6 months old
- Temp >39° C
- Fever >24hrs
- Absence of another source of infection

Inclusion Criteria: ≥2 months old with 1st or 2nd urinary tract infection (UTI)
Exclusion Criteria: <2 months old, past documented >2 UTI or pyelonephritis, pre-existing GU/Nephro abnormalities, concern for sepsis (see Septic Shock Clinical Pathway)

Initial Work Up:

If suspected UTI based on clinical picture **or**
presumed UTI (U/A with positive leukocyte esterase or nitrates, and/or >5 WBC and bacteria)

Meets Admission Criteria?
Requires IV antibiotics; immunocompromised; vomiting/unable to tolerate oral medication; lack of adequate follow-up

No

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U/A and culture should be obtained prior to starting antibiotics.
Review past culture results for potential resistance patterns.
If history of UTI with resistance, treat off pathway.

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Imaging:

- Renal bladder ultrasound if indicated:
  - All boys; all patients 2-24 months 1st or 2nd UTI; previously abnormal RBUS; urine culture positive for *Candida* or *Staphylococcus aureus*
  - Girls >24 months: provider discretion based on behavioral history such as toileting issues, constipation, and bladder dysfunction
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Follow Up:

- Urine culture for speciation. If enterococcus grows, change to amoxicillin 50 mg/kg/day div TID.
- Follow up sensitivities and adjust antibiotics if needed
- Schedule follow-up w/PCP
- If imaging abnormal, consider follow-up with Nephrology and/or Urology
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Requires IV antibiotics; immunocompromised; vomiting/unable to tolerate oral medication; lack of adequate follow-up

Definite UTI
(+U/A and +culture)?
Positive urine culture = SPA >100 cfu/ml ***OR*** *Clean catch: >10,000-100,000 cfu/ml of a single organism* ***OR*** *Cath: >10,000 cfu/ml*

No → Discontinue antibiotics and consider other sources of fever. Consider discussing with Infectious Diseases.

Yes

Antibiotics:

- *If urine culture grows enterococcus*: change to ampicillin IV 100 mg/kg/day div q6hr (max 4 g/day)
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Inpatient Care

In order to choose the correct antimicrobial, obtain urine studies prior to initiating antibiotics, and review any past cultures for potential resistances.

Start ceftriaxone IV.

Obtain chem 10, and consult nephrology if there is a concern for AKI.

- The definition of AKI has been updated to reflect KDIGO guidelines and local expert opinion

Meets Admission Criteria?
Requires IV antibiotics; immunocompromised; vomiting/unable to tolerate oral medication; lack of adequate follow-up

Yes

Antibiotics:

Obtain U/A and culture before starting antibiotics.
Review past culture results for potential resistances.

- Start empiric treatment with **Ceftriaxone IV**
  - 2-24 months old: 50 mg/kg/dose q24hr (max 1 g/day)
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Work-Up and Consults:

- iStat chem 10, if not done
  - If abnormal, send chem 10 to lab
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Inpatient Care

UTI is confirmed if there is a positive UA and positive culture.

A positive culture depends on the mode of specimen collection, as listed here.

- Greater than 100 cfu/ml for an SPA specimen
- Presence of at least 10,000 colony forming units per ML (cfu/ml) of a uropathogenic organism from a cath or clean catch specimen

*Note: The ≥10,000cfu/ml cut-off reflects the specific methods used by our local lab

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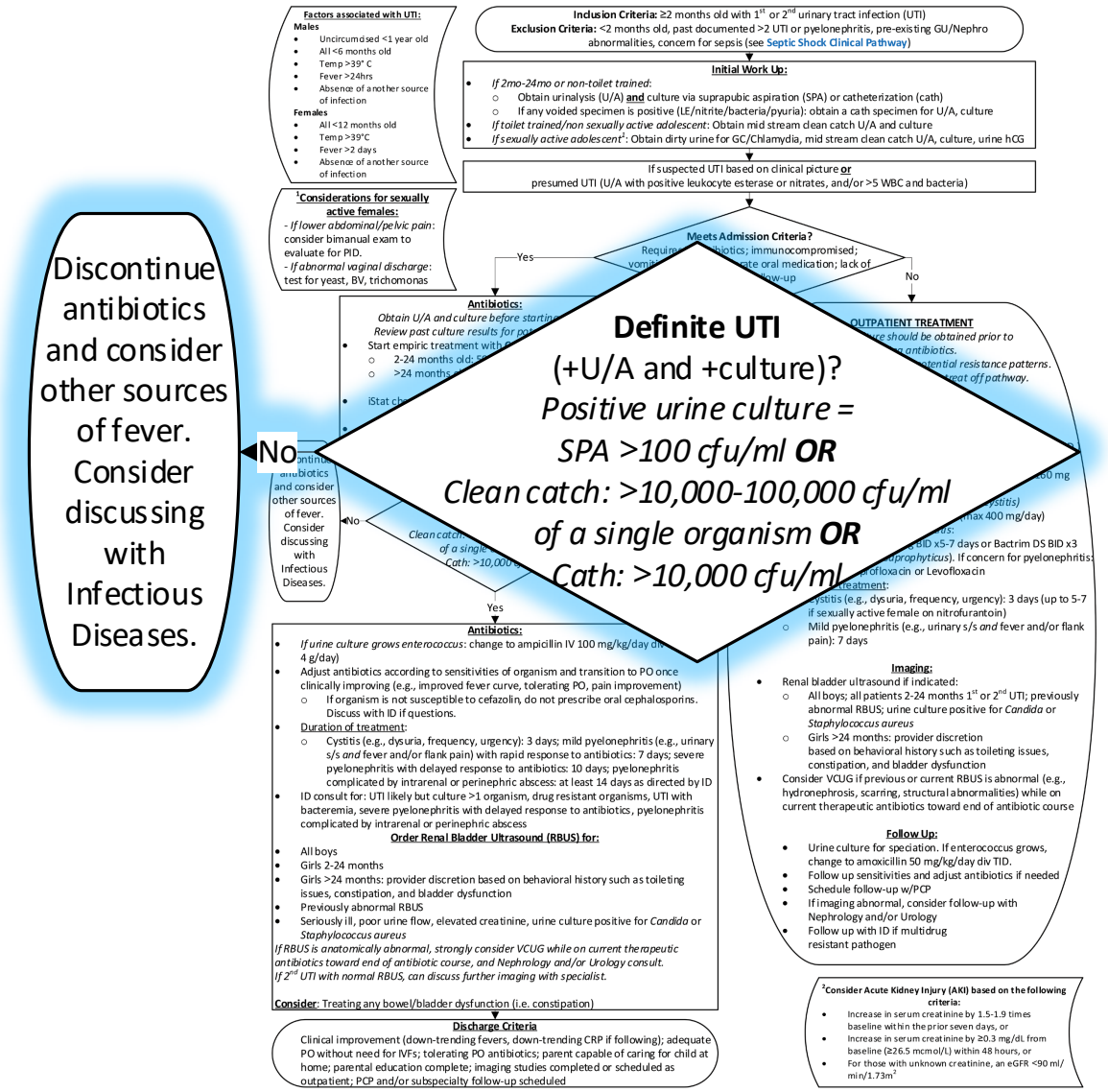

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Inpatient Care

If UTI is not confirmed, empiric antibiotics should be stopped.

Other sources of fever should be considered.

ID can be consulted if questions arise.

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[1]**Considerations for sexually active females:**
- *If lower abdominal/pelvic pain*: consider bimanual exam to evaluate for PID.
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Exclusion Criteria: <2 months old, past documented >2 UTI or pyelonephritis, pre-existing GU/Nephro abnormalities, concern for sepsis (see Septic Shock Clinical Pathway)

Initial Work Up:
- *If 2mo-24mo or non-toilet trained*:
  - Obtain urinalysis (U/A) **and** culture via suprapubic aspiration (SPA) or catheterization (cath)
  - If any voided specimen is positive (LE/nitrite/bacteria/pyuria): obtain a cath specimen for U/A, culture
- *If toilet trained/non sexually active adolescent*: Obtain mid stream clean catch U/A and culture
- *If sexually active adolescent*[1]: Obtain dirty urine for GC/Chlamydia, mid stream clean catch U/A, culture, urine hCG

If suspected UTI based on clinical picture **or** presumed UTI (U/A with positive leukocyte esterase or nitrates, and/or >5 WBC and bacteria)

Meets Admission Criteria?
Requires IV antibiotics; immunocompromised; vomiting; unable to take oral medication; lack of follow-up

Yes

Antibiotics:
Obtain U/A and culture before starting ant
Review past culture results for potenti
- Start empiric treatment with Ceft
  - 2-24 months old: 50 m
  - >24 months old
- iStat chem-7
- C

No

Discontinue antibiotics and consider other sources of fever. Consider discussing with Infectious Diseases.

No

Positive urine culture =
SPA >100 cfu/ml ***OR***
Clean catch: >10,000-100,000 cfu/ml
of a single organism ***OR***
Cath: >10,000 cfu/ml

Yes

Antibiotics:
- *If urine culture grows enterococcus*: change to ampicillin IV 100 mg/kg/day div q6hr (max 4 g/day)
- Adjust antibiotics according to sensitivities of organism and transition to PO once clinically improving (e.g., improved fever curve, tolerating PO, pain improvement)
  - If organism is not susceptible to cefazolin, do not prescribe oral cephalosporins. Discuss with ID if questions.
- Duration of treatment:
  - Cystitis (e.g., dysuria, frequency, urgency): 3 days; mild pyelonephritis (e.g., urinary s/s *and* fever and/or flank pain) with rapid response to antibiotics: 7 days; severe pyelonephritis with delayed response to antibiotics: 10 days; pyelonephritis complicated by intrarenal or perinephric abscess: at least 14 days as directed by ID
- ID consult for: UTI likely but culture >1 organism, drug resistant organisms, UTI with bacteremia, severe pyelonephritis with delayed response to antibiotics, pyelonephritis complicated by intrarenal or perinephric abscess

Order Renal Bladder Ultrasound (RBUS) for:
- All boys
- Girls 2-24 months
- Girls >24 months: provider discretion based on behavioral history such as toileting issues, constipation, and bladder dysfunction
- Previously abnormal RBUS
- Seriously ill, poor urine flow, elevated creatinine, urine culture positive for *Candida* or *Staphylococcus aureus*

If RBUS is anatomically abnormal, strongly consider VCUG while on current therapeutic antibiotics toward end of antibiotic course, and Nephrology and/or Urology consult.
If 2nd UTI with normal RBUS, can discuss further imaging with specialist.

Consider: Treating any bowel/bladder dysfunction (i.e. constipation)

Discharge Criteria
Clinical improvement (down-trending fevers, down-trending CRP if following); adequate PO without need for IVFs; tolerating PO antibiotics; parent capable of caring for child at home; parental education complete; imaging studies completed or scheduled as outpatient; PCP and/or subspecialty follow-up scheduled

Definite UTI
(+U/A and +culture)?
Positive urine culture =
SPA >100 cfu/ml ***OR***
Clean catch: >10,000-100,000 cfu/ml
of a single organism ***OR***
Cath: >10,000 cfu/ml

OUTPATIENT TREATMENT
should be obtained prior to antibiotics.
ential resistance patterns.
nt off pathway.

max: 160 mg

mple cystitis)
h cystitis:
PO (max 400 mg/day)
00 mg BID x5-7 days or Bactrim DS BID x3
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- Cystitis (e.g., dysuria, frequency, urgency): 3 days (up to 5-7 if sexually active female on nitrofurantoin)
- Mild pyelonephritis (e.g., urinary s/s *and* fever and/or flank pain): 7 days

Imaging:
- Renal bladder ultrasound if indicated:
  - All boys; all patients 2-24 months 1st or 2nd UTI; previously abnormal RBUS; urine culture positive for *Candida* or *Staphylococcus aureus*
  - Girls >24 months: provider discretion based on behavioral history such as toileting issues, constipation, and bladder dysfunction
- Consider VCUG if previous or current RBUS is abnormal (e.g., hydronephrosis, scarring, structural abnormalities) while on current therapeutic antibiotics toward end of antibiotic course

Follow Up:
- Urine culture for speciation. If enterococcus grows, change to amoxicillin 50 mg/kg/day div TID.
- Follow up sensitivities and adjust antibiotics if needed
- Schedule follow-up w/PCP
- If imaging abnormal, consider follow-up with Nephrology and/or Urology
- Follow up with ID if multidrug resistant pathogen

[2]**Consider Acute Kidney Injury (AKI) based on the following criteria:**
- Increase in serum creatinine by 1.5-1.9 times baseline within the prior seven days, or
- Increase in serum creatinine by ≥0.3 mg/dL from baseline (≥26.5 mcmol/L) within 48 hours, or
- For those with unknown creatinine, an eGFR <90 ml/min/1.73m^2

CONTACTS: MARTA NEUBAUER, MD | KARA DENZ FLUCK, PA

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Inpatient Care

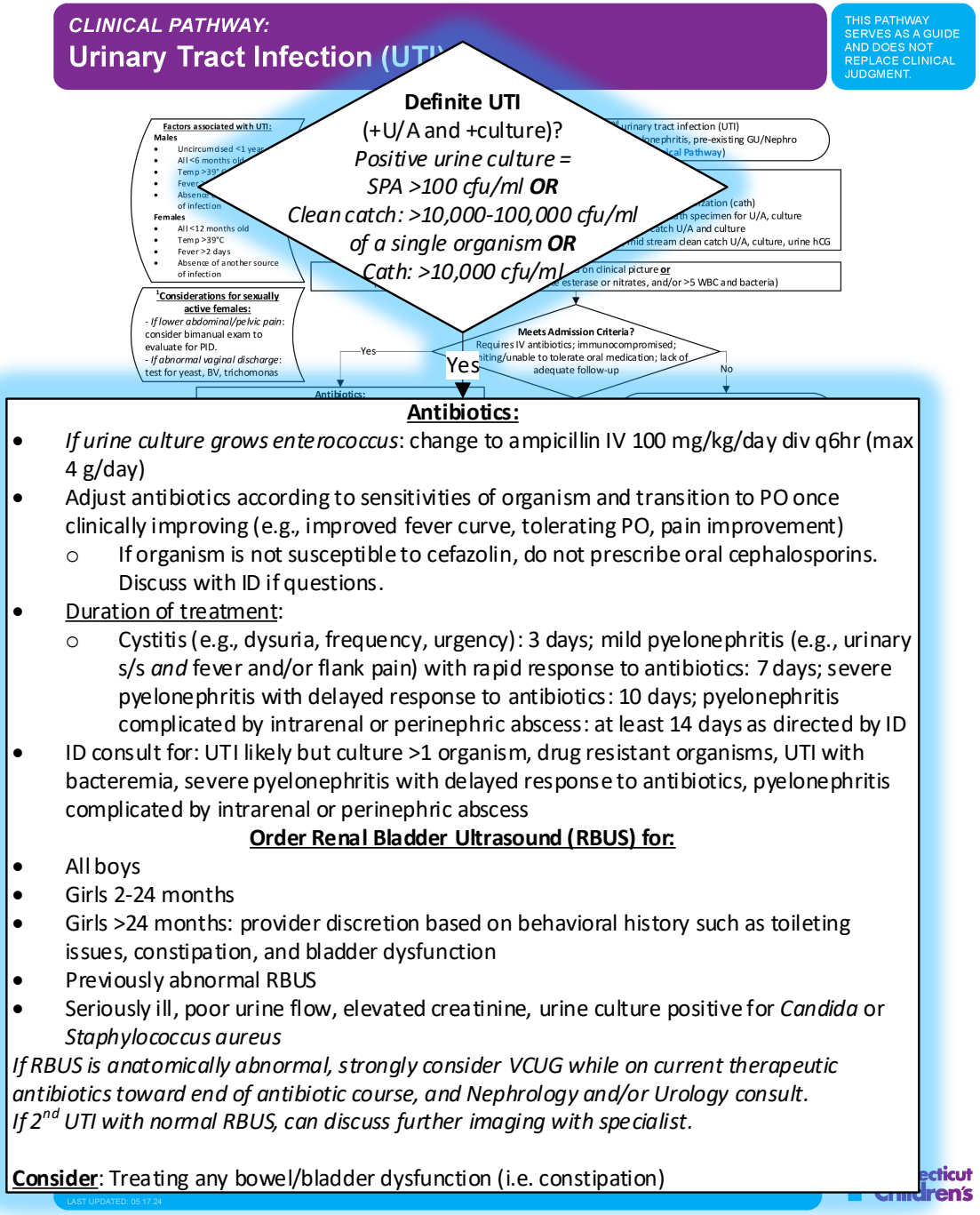
If UTI is confirmed, antibiotics should be adjusted toward the organism and sensitivities.

Important considerations:

- If enterococcus grows, ceftriaxone should be *changed* to ampicillin as ceftriaxone has no enterococcal coverage for UTI
- If sensitivities show that the organism is not susceptible to cefazolin, do not prescribe oral cephalosporins.
- ID should be consulted in specific situations, or if there are any questions.

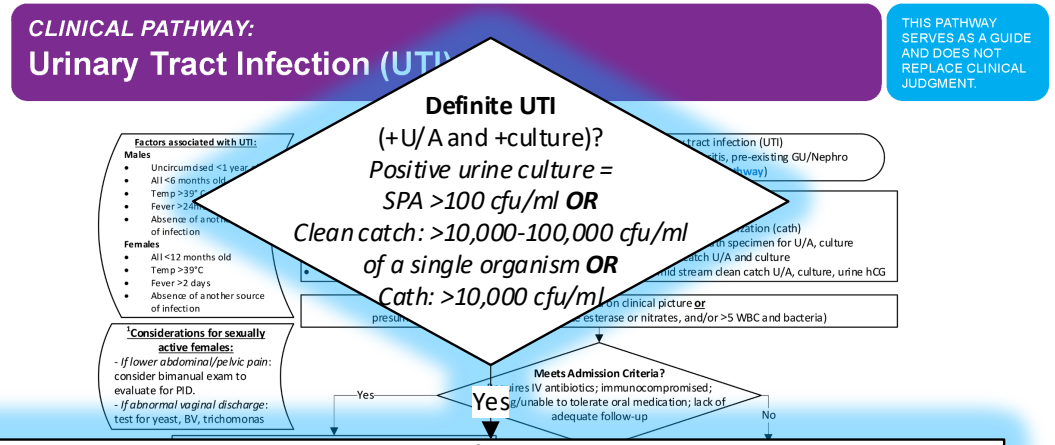
Duration of antibiotics:

Duration of antibiotics has been updated to provide the shortest necessary duration in order to reduce antimicrobial resistance



RBUS

- Non-invasive test
- Reveals the size and shape of the kidneys, the presence of duplication or dilation of the ureters and existence of gross anatomic abnormalities
- Yields management-altering abnormalities in 1-2% of the cases of first time febrile UTI
- **Recommended by the AAP for certain populations, particularly all 2-24 month olds following their first febrile UTI**



Antibiotics:

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If 2nd UTI with normal RBUS, can discuss further imaging with specialist.

Consider: Treating any bowel/bladder dysfunction (i.e. constipation)

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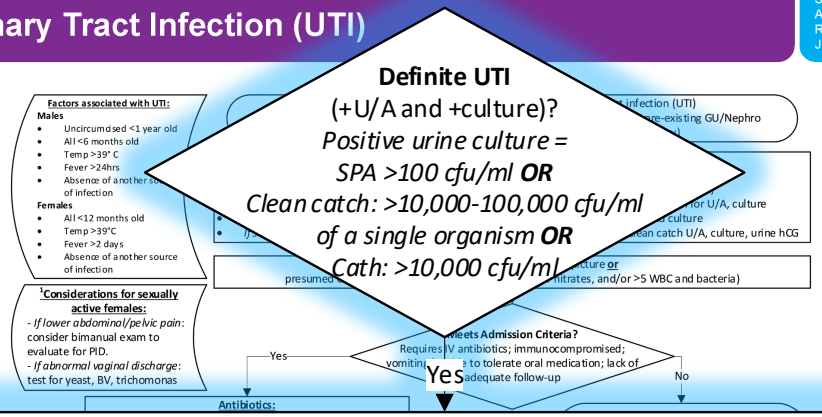
VCUG

- VUR: the retrograde passage of urine from the bladder into the upper urinary tract
  - VCUG is the test of choice to evaluate VUR
- Only recommended if RBUS is abnormal (NOT ROUTINE)
- Should be done towards the end of the current antibiotic therapy course
- Involves bladder catheterization
- Expensive and invasive
- Involves radiation exposure
- May miss a significant portion at risk of renal scarring
- **AAP guideline: The benefits of avoiding radiation exposure and discomfort in the majority of patients outweighs the delayed detection of a small number of cases of high grade reflux or other surgically corrected abnormalities.**

CLINICAL PATHWAY:

Urinary Tract Infection (UTI)

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.



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If 2nd UTI with normal RBUS, can discuss further imaging with specialist.

Consider: Treating any bowel/bladder dysfunction (i.e. constipation)

Discharge Criteria

Patients can be discharged on PO antibiotics once discharge criteria is met.

Ensure that the correct duration of antibiotics is given and that appropriate follow up is in place.

CLINICAL PATHWAY:

Urinary Tract Infection (UTI)

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Factors associated with UTI:

Males
- Uncircumcised <1 year old
- All <6 months old
- Temp >39° C
- Fever >24hrs
- Absence of another source of infection

Females
- All <12 months old
- Temp >39°C
- Fever >2 days
- Absence of another source of infection

[1]Considerations for sexually active females:
- *If lower abdominal/pelvic pain*: consider bimanual exam to evaluate for PID.
- *If abnormal vaginal discharge*: test for yeast, BV, trichomonas

Inclusion Criteria: ≥2 months old with 1st or 2nd urinary tract infection (UTI)
Exclusion Criteria: <2 months old, past documented >2 UTI or pyelonephritis, pre-existing GU/Nephro abnormalities, concern for sepsis (see Septic Shock Clinical Pathway)

Initial Work Up:
- *If 2mo-24mo or non-toilet trained*:
  - Obtain urinalysis (U/A) **and** culture via suprapubic aspiration (SPA) or catheterization (cath)
  - If any voided specimen is positive (LE/nitrite/bacteria/pyuria): obtain a cath specimen for U/A, culture
- *If toilet trained/non sexually active adolescent*: Obtain mid stream clean catch U/A and culture
- *If sexually active adolescent*[1]: Obtain dirty urine for GC/Chlamydia, mid stream clean catch U/A, culture, urine hCG

If suspected UTI based on clinical picture **or** presumed UTI (U/A with positive leukocyte esterase or nitrates, and/or >5 WBC and bacteria)

Meets Admission Criteria?
Requires IV antibiotics; immunocompromised; vomiting/unable to tolerate oral medication; lack of adequate follow-up

Yes →

Antibiotics:
Obtain U/A and culture before starting antibiotics.
Review past culture results for potential resistances.

No →

OUTPATIENT TREATMENT
U/A and culture should be obtained prior to

Discharge Criteria

Clinical improvement (down-trending fevers, down-trending CRP if following); adequate PO without need for IVFs; tolerating PO antibiotics; parent capable of caring for child at home; parental education complete; imaging studies completed or scheduled as outpatient; PCP and/or subspecialty follow-up scheduled

Consider discussing with Infectious Diseases.

Clean catch: >10,000-100,000 cfu/ml of a single organism **OR** *Cath: >10,000 cfu/ml*

Yes →

Antibiotics:
- *If urine culture grows enterococcus*: change to ampicillin IV 100 mg/kg/day div q6hr (max 4 g/day)
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If 2nd UTI with normal RBUS, can discuss further imaging with specialist.

Consider: Treating any bowel/bladder dysfunction (i.e. constipation)

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Clinical improvement (down-trending fevers, down-trending CRP if following); adequate PO without need for IVFs; tolerating PO antibiotics; parent capable of caring for child at home; parental education complete; imaging studies completed or scheduled as outpatient; PCP and/or subspecialty follow-up scheduled

- *If sexually active female with cystitis*:
  - Nitrofurantoin 100 mg BID x5-7 days or Bactrim DS BID x3 days (for *Staph. saprophyticus*). If concern for pyelonephritis: consider Ciprofloxacin or Levofloxacin
- Duration of treatment:
  - Cystitis (e.g., dysuria, frequency, urgency): 3 days (up to 5-7 if sexually active female on nitrofurantoin)
  - Mild pyelonephritis (e.g., urinary s/s *and* fever and/or flank pain): 7 days

Imaging:
- Renal bladder ultrasound if indicated:
  - All boys; all patients 2-24 months 1st or 2nd UTI; previously abnormal RBUS; urine culture positive for *Candida* or *Staphylococcus aureus*
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Follow Up:
- Urine culture for speciation. If enterococcus grows, change to amoxicillin 50 mg/kg/day div TID.
- Follow up sensitivities and adjust antibiotics if needed
- Schedule follow-up w/PCP
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[2]Consider Acute Kidney Injury (AKI) based on the following criteria:
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CONTACTS: MARTA NEUBAUER, MD | KARA DENZ FLUCK, PA

LAST UPDATED: 05.17.24

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Outpatient Care

Outpatient care reflects inpatient care for antibiotics, duration, and imaging.

Cephalexin should be started if a UTI is confirmed but the patient doesn't meet admission criteria.

- Options are given for allergies and for sexually active females with cystitis

Follow up

- Follow up on urine culture for speciation and sensitivities to adjust antibiotics if necessary
- If RBUS is abnormal, follow up should be made for further imaging and management.
- ID should follow if a multi-drug resistant organism grows

CLINICAL PAT
Urinary T

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

OUTPATIENT TREATMENT

U/A and culture should be obtained prior to starting antibiotics.
Review past culture results for potential resistance patterns.
If history of UTI with resistance, treat off pathway.

Antibiotics:

- **Cephalexin** PO 50 mg/kg/day div TID
(If concern for pyelonephritis: 100 mg/kg/day div TID-QID, max 4 g/day. MIC should be ≤2 for cefazolin. If MIC >2, discuss w/ID.)
- *If PCN allergy:*
  - **Bactrim** 8 mg TMP/kg/day PO divided BID (max: 160 mg TMP single dose) or
  - **Nitrofurantoin** *(only for use in simple cystitis)* 5-7 mg/kg/day divided q6hr PO (max 400 mg/day)
- *If sexually active female with cystitis*:
  - Nitrofurantoin 100 mg BID x5-7 days or Bactrim DS BID x3 days (for *Staph. saprophyticus*). If concern for pyelonephritis: consider Ciprofloxacin or Levofloxacin
- Duration of treatment:
  - Cystitis (e.g., dysuria, frequency, urgency): 3 days (up to 5-7 if sexually active female on nitrofurantoin)
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- If imaging abnormal, consider follow-up with Nephrology and/or Urology
- Follow up with ID if multidrug resistant pathogen

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LAST UPDATED: 05.17.24

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Quality Metrics

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- Percentage of patients with use of UTI order set
- Percentage of patients age 2 to 24 month with 1st time UTI ordered for renal ultrasound
- Percentage of patients receiving VCUG
- Percentage of patients with first line antibiotic choice per pathway recommendations
- Percentage of patients with appropriately dose antibiotics per pathway
- Percentage of patients with appropriate duration of antibiotics
- Monthly average duration of antibiotic courses
- Length of stay ED (minutes) and inpatient (days)

Pathway Contacts

Connecticut Children's

- Marta Neubauer, MD
  - Pediatric Hospital Medicine
- Kara Denz Fluck, PA-C
  - Pediatric Hospital Medicine

References

Connecticut Children's

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Thank You!

Connecticut Children's

About Connecticut Children's Pathways Program

Clinical pathways guide the management of patients to optimize consistent use of evidence-based practice. Clinical pathways have been shown to improve guideline adherence and quality outcomes, while decreasing length of stay and cost. Here at Connecticut Children's, our Clinical Pathways Program aims to deliver evidence-based, high value care to the greatest number of children in a diversity of patient settings. These pathways serve as a guide for providers and do not replace clinical judgment.