



Infections of Upper and Lower Urinary Tract

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Disclosures of Financial Relationships with Relevant Commercial Interests

- None

Topics to Cover

- Acute cystitis in women
- Recurrent cystitis in women
- Asymptomatic bacteriuria
- Catheter-associated UTI
- Complicated UTI
- Pyelonephritis
- Urosepsis and worse



UTI Differs in Different Populations

UTI is not the same entity in these different populations



The Great Divide in UTI Knowledge (Cystitis)

My Patient Populations

- Men
- Older adults in long-term care
- Persons who require urinary catheters for bladder drainage
- Persons with neurogenic bladders

UTI Treatment Evidence Base

- Pre-menopausal women
- Female college students and university staff

The screenshot shows the IDSA (Infectious Diseases Society of America) website. The top navigation bar includes links for ID Topics, Practice Resources, Education & Training, and Policy & Advocacy. Below the navigation bar, there is a link to 'View All Guidelines'. The main heading reads 'IDSA PRACTICE GUIDELINES' with a 'CURRENT' indicator. The title of the guideline is 'Complicated Urinary Tract Infections (cUTI): Clinical Guidelines for Treatment and Management'. At the bottom, it states 'Published July 17, 2025'.

New classifications of uUTI and cUTI

Old Classifications

Uncomplicated UTI:

Acute cystitis in afebrile nonpregnant premenopausal women with no diabetes and no urologic abnormalities



Acute Pyelonephritis: Acute kidney infection in women otherwise meeting the definition of uncomplicated UTI above



Complicated UTI: All other UTIs

New Classifications

Uncomplicated UTI: Infection confined to the bladder in afebrile women or men

Complicated UTI: Infection beyond the bladder in women or men

- Pyelonephritis
- Febrile or bacteremic UTI
- Catheter-associated (CAUTI)
- Prostatitis* (*not covered by these guidelines)



SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Question #1

- A 24-year-old woman is evaluated for cystitis symptoms of 3 days' duration. She reports no fever, chills, flank pain, or vaginal discharge. She had similar symptoms three months ago and was treated with trimethoprim-sulfamethoxazole, with relief of symptoms.
- On physical examination, vital signs and other findings are unremarkable.
- On microscopic urinalysis, leukocytes are too numerous to count, erythrocyte count is 10/hpf, 4+ bacteria are present, and rare squamous epithelial cells are seen. Urine pregnancy test is negative.

Which of the following is the most appropriate management?

- Nitrofurantoin
- TMP/SMX
- Fosfomycin
- Ciprofloxacin
- Ibuprofen

HPF: high-powered field; TMP/SMX: trimethoprim/sulfamethoxazole

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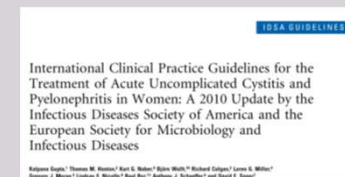
- A. Nitrofurantoin* (Best choice for uncomplicated cystitis when TMP/SMX not an option)
- B. TMP/SMX
- C. Fosfomycin
- D. Ciprofloxacin
- E. Ibuprofen

HPF: high-powered field; TMP/SMX: trimethoprim/sulfamethoxazole

Infectious Diseases Society of America (IDSA) Uncomplicated UTI Guidelines*

*Complicated UTI guidelines released July 2025

- These guidelines cover:
- Uncomplicated cystitis
- Uncomplicated pyelonephritis
- Premenopausal women
- Primarily outpatients



IDSA Cystitis Guidelines (2010)

First-line Agents

- Nitrofurantoin
- Trimethoprim-sulfamethoxazole
- Fosfomycin
- Pivmecillinam

Alternative Choices

- Fluoroquinolones
- Beta-lactams

Can one of the recommended antimicrobials* below be used considering: Availability Allergy history Tolerance
Nitrofurantoin monohydrate/macrocrystals 100 mg bid X 5 days (avoid if early pyelonephritis suspected)
OR
Trimethoprim-sulfamethoxazole 160/800 mg (one DS tablet) bid X 3 days (avoid if resistance prevalence is known to exceed 20% or if used for UTI in previous 3 months)
OR
Fosfomycin trometamol 3 gm single dose (lower efficacy than some other recommended agents; avoid if early pyelonephritis suspected)
OR
Pivmecillinam 400 mg bid x 5 days (lower efficacy than some other recommended agents; avoid if early pyelonephritis suspected)

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

BID: twice daily; DS: double strength

How Long do you Treat Acute Cystitis?

First line choices (5, 3, 1)

- Nitrofurantoin X 5
- Pivmecillinam X 5
- Trimethoprim/sulfamethoxazole X 3
- Fosfomycin X1

IDSA Guidelines on Uncomplicated Cystitis, 2010

Antibiotics for Cystitis: Key Points

- Nitrofurantoin
 - High barrier to resistance in *E. coli*
 - Pulmonary toxicity (rare), hepatic toxicity (very rare)
- Pivmecillinam
 - TID dosing
 - Very expensive in US
- Trimethoprim/sulfamethoxazole
 - Significant resistance particularly among *E. coli*
 - Watch out for hyperkalemia, mild creatinine elevation, rashes
- Fosfomycin
 - Expensive in US
 - Sensitivity testing not automated

New Antibiotics for UTI with FDA Approval

Uncomplicated UTI

- Pivmecillinam
- Gepotidacin
- Sulopenem etzadroxil/probenecid

Complicated UTI

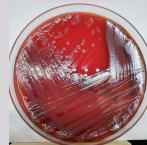
- Tebipenem pivoxil
- Fosfomycin disodium (IV)
- Cefepime/zidebactam

Barriers to use:

Cost, lack of susceptibility testing, availability

New Oral Drugs for Cystitis: FDA Approved for Uncomplicated UTI

- Pivmecillinam (Pivva)
 - Pro-drug of mecillinam
 - Binds to PBP-2 in Gram-negative cell wall
 - Effective against ESBL+ Enterobacterales, *Staph saprophyticus*
- Gepotidacin (Blujepa)
 - Blocks DNA topoisomerase
 - Effective against ESBL+ Enterobacterales, *S. saprophyticus*, and *E. faecalis*
 - Does not get into the prostate or kidneys
 - Also approved for gonorrhea
- Sulopenem etzadroxil/probenecid (Orlynvah)
 - Thiopenem—new beta-lactam class
 - Effective against ESBL+ Enterobacterales, *S. saprophyticus*
 - Did not get approval for complicated UTI



Not for *Pseudomonas* or VRE

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Question #2

- A 38-year-old woman comes in for recurrent UTI. This is her 3rd episode of symptomatic, culture-proven cystitis in the past 12 months. The recurrent UTIs are very inconvenient to her. She notes that her UTI symptoms usually begin within 2 days of sexual intercourse.
- You offer an antibiotic prescription to allow her to self-treat when she feels the cystitis symptoms developing, but she travels internationally and would rather completely avoid developing a UTI.

Which of the following is the most appropriate strategy to prevent recurrent UTI in this woman?

- A. Nitrofurantoin daily for 24 months
- B. Nitrofurantoin one dose after intercourse for 6 months
- C. Ciprofloxacin daily for 6 months
- D. Trimethoprim-sulfamethoxazole twice daily for 6 months
- E. Cranberry tablets

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Question #2 - Rationale

- A 38-year-old woman comes in for recurrent UTI. This is her 3rd episode of symptomatic, culture-proven cystitis in the past 12 months. The recurrent UTIs are very inconvenient to her. She notes that her UTI symptoms usually begin within 2 days of sexual intercourse.
- You offer an antibiotic prescription to allow her to self-treat when she feels the cystitis symptoms developing, but she travels internationally and would rather completely avoid developing a UTI.

Which of the following is the most appropriate strategy to prevent recurrent UTI in this woman?

- A. Nitrofurantoin daily for 24 months - duration usually 3-6 months
- B. Nitrofurantoin one dose after intercourse for 6 months* - use antibiotics specifically after her trigger situations**
- C. Ciprofloxacin daily for 6 months - not a good drug for prophylaxis
- D. Trimethoprim-sulfamethoxazole twice daily for 6 months - dose is too high
- E. Cranberry tablets - minimal data to support

Prevention and Management of Recurrent UTI

- Self-treatment coupled with urine collection for culture is an appropriate strategy
- Use the most focused antibiotic and as sparingly as possible
- If the woman's episodes are related to sexual intercourse, one dose of antibiotics before or after intercourse is an effective strategy
- Guidelines suggest treating daily for 3-12 months
- No clarity on which antibiotic to use, other than to avoid fluoroquinolones given side effects and resistance

Recurrent Uncomplicated Urinary Tract Infections in Women: AUA/GUA/SUFU Guideline (2025)
<https://www.auanet.org/guidelines-and-quality/guidelines/recurrent-uti>

Non-antibiotic Strategies to Prevent Recurrent UTI

Likely Helpful (FDA Approved)

- Increasing fluid intake
- Vaginal estrogen in post-menopausal women
- Methenamine hippurate

Uncertain Benefit (Not FDA Approved)

- Other behavioral changes
- Cranberry products
- D-mannose
- Probiotics
- Other supplements

Fluid intake: Hooton TM, et al. JAMA Intern Med. 2018
Methenamine trials: Harding C, et al. ALTAR trial. Health Technol Assess. 2022
Botros C, et al. Int J Urogynecol J. 2022; Helvest-Olsen ImpresU trial. Clin Microbiol Infect 2025
Systematic review of cranberry products: Williams G, et al. Cochrane Database Syst Rev. 2023

Question #3

- A 69-year-old woman comes in for an annual checkup. No change in her baseline health status. When she coughs or sneezes, she notes slight leakage of urine. Her medical history is significant for three vaginal births, and she has hypertension and type 2 diabetes mellitus.
- Her vital signs and other physical examination findings are normal.
- On dipstick urinalysis, urine is yellow and with a bad smell, specific gravity is 1.010, pH is 7.0, and moderate leukocyte esterase and nitrites are present; the urinalysis is negative for blood or glucose but 2+ for bacteria.

Which of the following is the most appropriate management?

- A. Nitrofurantoin
- B. Ciprofloxacin
- C. Cystoscopy
- D. Urine culture and sensitivities
- E. No further infectious workup

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Prevalence of Asymptomatic Bacteriuria

Population	Prevalence, %
Children	
Boys	<1
Girls	1-2
Healthy women	
Premenopausal	1.0-5.0
Pregnant	1.9-9.5
Postmenopausal (age 50-70 y)	2.8-8.6
Persons with diabetes	
Women	10.8-16
Men	0.7-11
Elderly persons in the community (age ≥70 y)	
Women	10.8-16
Men	3.6-19
Elderly persons in a long-term care facility	
Women	25-50
Men	15-50
Persons with spinal cord injury	
Intermittent catheter use	23-69
Sphincterotomy/condom catheter	57
Persons with kidney transplant	
First month posttransplant	23-24
1 mo-1 y post-transplant	10-17
>1 y post-transplant	2-9
Persons with indwelling catheter use	
Short-term	3%-5%/day catheter
Long-term	100

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION.

Mo: month; y: year

Nicolle et al, IDSA Guidelines for Asymptomatic Bacteriuria, Clin Inf Dis 2019

Choosing Wisely®

An initiative of the ABIM Foundation



Five Things Physicians and Patients Should Question

Don't treat asymptomatic bacteriuria with antibiotics.

Inappropriate use of antibiotics to treat asymptomatic bacteriuria (ASB), or a significant number of bacteria in the urine that occurs without symptoms such as burning or frequent urination, is a major contributor to antibiotic overuse in patients. With the exception of pregnant patients, patients undergoing prostate surgery or other invasive urological surgery, and kidney or kidney pancreas organ transplant patients within the first year of receiving the transplant, use of antibiotics to treat ASB is not clinically beneficial and does not improve morbidity or mortality. The presence of a urinary catheter increases the risk of bacteriuria, however, antibiotic use does not decrease the incidence of symptomatic catheter-associated urinary tract infection (CAUTI), and unless there are symptoms referable to the urinary tract or symptoms with no identifiable cause, catheter-associated asymptomatic bacteriuria (CA-ASB) does not require screening and antibiotic therapy. The overtreatment of ASB with antibiotics is not only costly, but can lead to C. difficile infection and the emergence of resistant pathogens, raising issues of patient safety and quality.

IDSA Guidelines on ASB 2019

Screening and Treatment Indicated

- Pregnant women
- Prior to urologic surgery with mucosal trauma
 - Pre-operative urine culture recommended
 - Treat with 1-2 doses of antibiotics shortly prior to surgery

Screening and Treatment Discouraged

- Infants and children
- Non-pregnant women
- Functionally-impaired older adults
- Diabetic adults
- Patients >1 month from kidney transplant
- Neutropenic patients
- Patients with solid organ transplant
- Persons with spinal cord injury
- Patients with indwelling catheters
- Prior to non-urologic surgery

Guidelines on Screening for ASB in Pregnant Women

Agency	Year	Recommended?	Strength?	When?	How?	Desired Outcomes
IDSA (United States)	2019	Yes	Strong	12-16 weeks	Culture	Decreased pyelonephritis, decreased low birth weight Possible decrease in preterm labor
CTFPHC (Canadian)	2018	Yes	Weak	1 st trimester	Culture	Decreased pyelonephritis, decreased low birth weight
USPSTF (United States)	2019	Yes	Grade B	12-16 weeks or first prenatal visit	Culture	Decreased pyelonephritis, decreased low birth weight

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION CTFPHC, Canadian Task Force on Preventive Health Care; USPSTF, United States Preventive Services Task Force

Warning: Myth-busting Ahead!



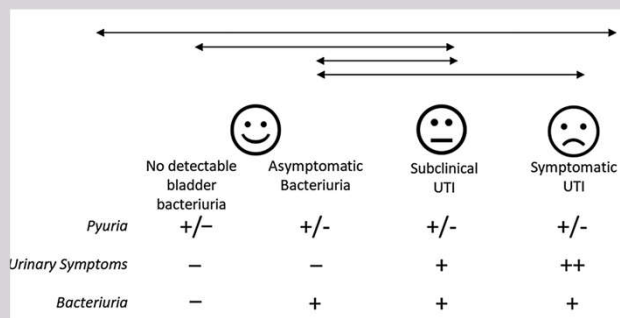
Myth-Busting

- Bacteriuria ≠ UTI
- Pyuria ≠ UTI
 - WBC in the urine doesn't help much with diagnosis of UTI
 - Absence of pyuria suggests to look for a non-UTI diagnosis
- Foul smelling urine ≠ UTI
- Sediment or cloudy urine in catheter tubing ≠ UTI
 - Try flushing the catheter
- Healthy bladders are not sterile in many people
- Take home points:
 - Order urine tests only in patients with urinary symptoms
 - The best thing you can do with asymptomatic bacteriuria is leave it alone
 - Pyuria is not a reliable marker for UTI
 - Changes in the urine are not reliable markers for UTI



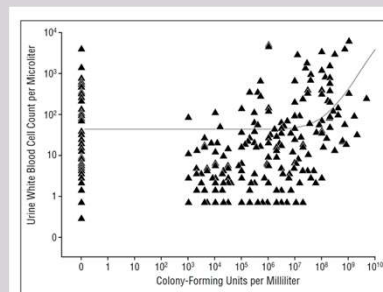
WBC: white blood cell

The Continuum of UTI



Trautner, Clin Infect Dis, 2020

Relationship Between Pyuria and Bacteriuria/Candiduria in Catheterized Patients



CFU: colony-forming unit

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

1,497 newly catheterized patients followed daily with urine testing and symptom diaries

235 developed bacteriuria with at least 1,000 CFU/mL

No significant differences in fever or urinary symptoms between patients who did/did not develop bacteriuria

No correlation between pyuria and bacteriuria (flat line) until colony counts are over 10^8

Tambyah and Maki, Arch Intern Med, 2000 Mar 13;160(5):678-82 and 673-7

Question #4

- A 75-year-old man is seen in the pre-operative clinic. He is scheduled to undergo cystoscopy and possible biopsy for persistent hematuria. He is also scheduled for elective left total knee replacement, shortly after the urinary procedure. Other than the hematuria, he denies urinary-specific symptoms. He underwent kidney transplantation 3 years earlier, related to complications of diabetes.
- On physical examination, vital signs are normal. His left knee has an effusion but is not red or excessively painful. No change in his baseline creatinine clearance.
- On urinalysis, leukocyte count is 10/hpf, erythrocyte count is 100/hpf, 4+ bacteria are present, and no squamous epithelial cells are seen. Urine culture grew >10,000-<100,000 colony-forming units of *Klebsiella pneumoniae*.
- Kidney ultrasonography is unremarkable.

Which of the following is the primary indication for antimicrobial therapy in this patient?

- Cystoscopy and biopsy
- Diabetes mellitus
- Kidney transplant
- Knee prosthesis placement

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- Kidney ultrasonography is unremarkable.

Which of the following is the primary indication for antimicrobial therapy in this patient?

- Cystoscopy and biopsy* - will breach the mucosa, and bacteriuria would contaminate the surgical field
- Diabetes mellitus - no, see ASB guidelines
- Kidney transplant - not necessary to treat ASB after >1 month post transplant
- Knee prosthesis placement - not fully addressed in the 2019 ASB guidelines

Question #5

- A 46-year-old man is admitted to the hospital for urgent repair of aortic dissection. An indwelling urinary catheter is inserted prior to surgery. Endovascular aortic aneurysm repair is successful, and he is transferred to the surgical intensive care unit. He has underlying diabetes and systolic heart failure.

In addition to removing the urinary catheter as soon as possible, which of the following will decrease this patient's risk of catheter-associated urinary tract infection?

- A. Daily cleansing of the meatal area of the catheter with antiseptics
- B. Routine catheter change every 3 days
- C. Screening for and treatment of bacteriuria
- D. Keeping the collecting bag below the level of the bladder
- E. Use of antiseptic- or antibiotic-coated urinary catheters

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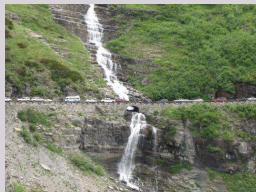
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In addition to removing the urinary catheter as soon as possible, which of the following will decrease this patient's risk of catheter-associated urinary tract infection?

- A. Daily cleansing of the meatal area of the catheter with antiseptics
 - Ineffective
- B. Routine catheter change every 3 days
 - Ineffective
- C. Screening for and treatment of bacteriuria
 - Ineffective AND confers excess antibiotic use
- D. Keeping the collecting bag below the level of the bladder***
 - Gravity helps prevent reflux to kidneys *
- E. Use of antiseptic-coated urinary catheters
 - Minimal impact and approved only for short-term use



Question #6

- An 80-year-old man with T12 paraplegia and an indwelling Foley presents with suspected complicated UTI. He has a temp of 100.1 F and rigors. SOFA score 2, responds to fluid resuscitation (sepsis, without shock). In the prior 12 months his urine cultures showed E. coli and Klebsiella resistant to TMP/SMX, cefazolin, and ceftriaxone. No fluoroquinolone exposure within the past year. No allergies to any antibiotics.

Assuming that the antibiogram shows greater than 80% susceptibility to all of the following antibiotics, which are the best options?

- A. Levofloxacin
- B. Ertapenem
- C. Ceftazidime-avibactam
- D. Gentamicin
- E. A or B

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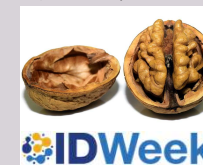
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- D. Gentamicin
- E. A or B*

IDSA cUTI Guideline in a Nutshell



- New classification of cUTI
 - Includes febrile UTI, pyelonephritis, CAUTI, bacteremic UTI
- Selection of empiric antibiotic therapy for cUTI
 - Four-step process:** Review (1) severity of illness, (2) risk factors for resistant organisms, (3) patient factors, and (4) antibiogram (only if septic)
 - Preferred agents (select from remaining options AFTER completing steps above):** third- or fourth-generation cephalosporins, carbapenems (if septic), piperacillin-tazobactam, or fluoroquinolones
- Route of antibiotic therapy
 - Oral switch recommended versus continuing IV
- Duration of antibiotic therapy
 - 7 days recommended versus longer courses



Choice of Empiric Agent for cUTI



Condition of the Patient	Preferred	Alternative
Sepsis with or without shock	Third or fourth generation cephalosporins, carbapenems, piperacillin-tazobactam, fluoroquinolones	Novel beta lactam-beta lactamase inhibitors, cefiderocol, plazomicin, or older aminoglycosides
Without sepsis, IV route of therapy	Third or fourth generation cephalosporins, piperacillin-tazobactam, or fluoroquinolones	Carbapenems, newer agents (novel beta lactams-beta lactamase inhibitors, cefiderocol, plazomicin), or older aminoglycosides
Without sepsis, oral route of therapy	Fluoroquinolones or trimethoprim-sulfamethoxazole	Amoxicillin-clavulanate or oral cephalosporins

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

IDSA treatment approach



- Step 1**
 - Consider severity of illness:**
 - Sepsis with shock, sepsis without shock, no sepsis
- Step 2**
 - Evaluate patient-specific risk factors for resistant organisms:**
 - Avoid antibiotics to which patient has had resistant pathogen previously isolated
 - Avoid fluoroquinolones (FQ) if patient exposed to FQ in past 12 months
- Step 3**
 - Assess other patient-specific factors:**
 - Risk of allergic reaction, contraindications, drug-drug interactions
- Step 4**
 - If septic use antibiogram to tailor empiric therapy:**
 - Consider at least 90% susceptibility threshold for sepsis with shock
 - Consider at least 80% susceptibility threshold for sepsis without shock
 - Patients not septic have lower (<5%) risk of mortality and initial inappropriate empiric choice has little impact on mortality



SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Let's apply the 4 steps to our patient:

- 80-year-old man with ASIA paraplegia below T12
- Neurogenic bladder with chronic indwelling Foley
- Temp of 100.1F with rigors
- SOFA score = 2 (STEP 1)
 - No pressors needed (sepsis, without shock)
- Urine cultures within past 12 months (STEP 2)
 - *E. coli* and *Klebsiella* resistant to TMP/SMX, cefazolin, and ceftriaxone
- No fluoroquinolone exposure within the past year (STEP 2)
- No allergies or contraindications to any antibiotics (STEP 3)



Applying the Antibigram (Step 4)

Susceptibilities:	Levofloxacin	Ceftriaxone	Ertapenem	Ceftazidime-Avibactam	Amikacin
<i>E. coli</i>	82%	85%	90%	95%	99%

- Consider the source of the antibiogram isolates (#, timing, setting)
- For sepsis without shock, the target is at least 80% susceptibility
- Best choices for this patient with sepsis, no shock

A. Levofloxacin

B. Ertapenem

C. Ceftazidime-avibactam—less preferred due to stewardship issues

D. Gentamicin—less preferred due to renal toxicity

E. A or B

Urine grew ESBL+ *E. coli*,
treated with ciprofloxacin



Question #7

- A 37-year-old woman with a history of recurrent UTIs developed typical symptoms of urgency, frequency, and dysuria five days ago. On the advice of her close friend, she decided to treat this UTI with a nutritional supplement instead of antibiotics. Symptoms did not resolve, and she developed worsening low back pain. This morning she vomited once. In the office, her temperature is 100.5F, BP 135/70, HR 110, RR 16. She is not currently vomiting and can sip water.
- You do not have any prior urine cultures to guide your therapy. She took some antibiotics for UTI 3 months ago but doesn't know what she took.

Assuming you can manage her as an outpatient, what empiric treatment would you offer?

- A. Oral trimethoprim-sulfamethoxazole (TMP/SMX)
- B. Oral ciprofloxacin
- C. One dose of ceftriaxone or gentamicin followed by oral ciprofloxacin or TMP/SMX
- D. Oral fosfomycin
- E. Nitrofurantoin

BP, blood pressure; HR, heart rate; IM, intramuscular; RR, respiratory rate

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BP, blood pressure; HR, heart rate; IM, intramuscular; RR, respiratory rate

Question #7: Rationale

- A 37-year-old woman with a history of recurrent UTIs developed typical symptoms of urgency, frequency, and dysuria five days ago. On the advice of her close friend, she decided to treat this UTI with a nutritional supplement instead of antibiotics. Symptoms did not resolve, and she developed worsening low back pain. This morning she vomited once. In the office, her temperature is 100.5F, BP 135/70, HR 110, RR 16. She is not currently vomiting and can sip water.
- You do not have any prior urine cultures to guide your therapy. She took some antibiotics for UTI 3 months ago but doesn't know what she took.

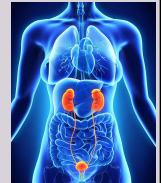
Assuming you can manage her as an outpatient, what empiric treatment would you offer?

- A. Oral trimethoprim-sulfamethoxazole (TMP/SMX)
- B. Oral ciprofloxacin
- C. **One dose of ceftriaxone or gentamicin followed by oral ciprofloxacin or TMP/SMX* - safest empiric options without cultures to guide you and with known prior antibiotic exposure**
- D. Oral fosfomycin - unclear role in pyelonephritis as initial therapy
- E. Nitrofurantoin - not effective tissue levels

BP, blood pressure; HR, heart rate; IM, intramuscular; RR, respiratory rate

Management of Pyelonephritis

- Many clinical trials included pyelonephritis with complicated UTI
- Complicated UTI means urinary tract infection that has spread beyond the bladder (to kidneys, bloodstream)
- Empiric oral therapy
 - Trimethoprim-sulfamethoxazole 7 days
 - Fluoroquinolones 5-7 days
 - Consider a one-time dose of IM ceftriaxone or gentamicin while awaiting cultures
 - Oral beta-lactams (cephalosporins, amoxicillin-clavulanate)
- Empiric intravenous therapy
 - Cephalosporins, fosfomycin, piperacillin-tazobactam, carbapenems, fluoroquinolones
- To avoid: nitrofurantoin
- Role of fosfomycin as initial therapy unclear; effective as step down



Question #8

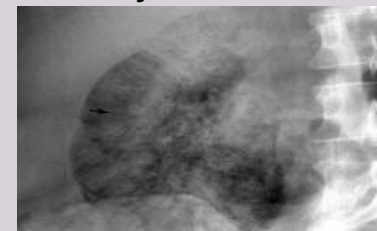
- 68-year-old diabetic man with CHF, vascular disease, BPH presented with 2 days of vomiting, abdominal pain, and confusion.
- Vital signs: T 99.9 BP 47/39, HR 110, RR 22
- Physical exam: patient was obtunded but appeared to have tenderness in the epigastric area
- Labs: WBC 23.7 (94% segs), platelets 96K; Creatinine 3.1 (from 1.7 baseline)
UA: WBC 250, RBC too numerous to count, no bacteria
Troponin 7.2, EKG with ST elevations; HgB A1c 10.5
- He was admitted to the CCU and initiated on therapy for an ST elevation myocardial infarction. His blood pressure was labile, and he required pressor support. He required intubation. On hospital day 2, his blood cultures grew 4/4 bottles of *Klebsiella pneumoniae*.
- The next slide shows an abdominal radiography (KUB) that had been performed at admission

Question #8

What would you order next?

- A. Abdominal ultrasound
- B. Abdominal CT
- C. Nasogastric tube
- D. Stool for *C. diff* testing

X-Ray of Abdomen

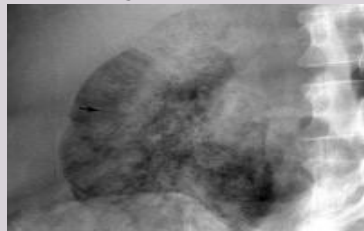


Question #8

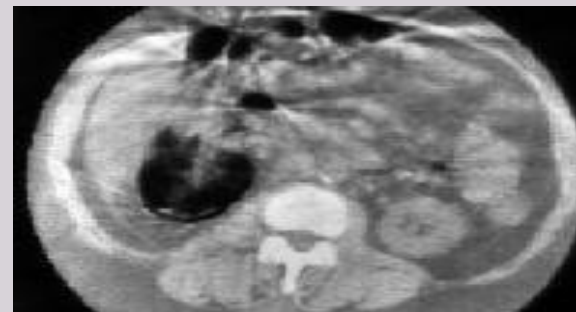
What would you order next?

- A. Abdominal ultrasound
- B. Abdominal CT***
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X-Ray of Abdomen



Abdominal CT with Emphysematous Pyelonephritis



CT showing gas within the renal parenchyma

Clinical Course of Question #8 Case

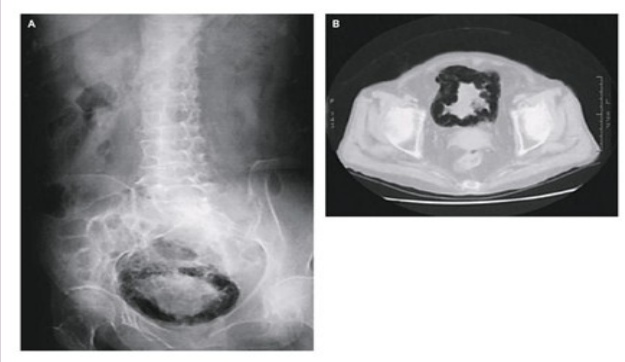
- Percutaneous drainage of the right kidney
- Renal drainage grew *Klebsiella*
- After weeks in the ICU was stable enough for nephrectomy
- 9 months later had then coronary artery bypass surgery

Diagnosis and Management of Emphysematous Pyelonephritis

- 95% of cases in patients with diabetes (poorly controlled)
- Negative prognostic factors: shock, impaired consciousness, thrombocytopenia, renal failure
- Organisms: *E. coli*, *Klebsiella*, *Proteus*
- Diagnosis often delayed
- Differential: renal abscess, papillary necrosis
- Radiological diagnosis
- **Managed initially by drainage** - percutaneous nephrostomy or ureteral stent
- Nephrectomy for non-responders, severe cases

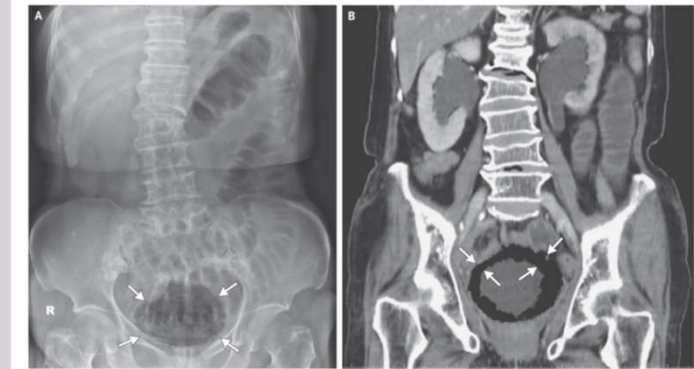
Kamei, J Infection and Chemotherapy 2021

Emphysematous Cystitis



Asada, NEJM 2003;349:258

Emphysematous Cystitis



Tzou, NEJM 2016;375:18

Diagnosis and Management of Emphysematous Cystitis

- Female predilection
- Most cases in diabetics
- Commonly caused by *E. coli*, *Klebsiella* (*Candida* reported)
- Organisms produce gas in the bladder wall and lumen
- Can present with lower abdominal pain
- Diagnosed radiologically
- Relieve bladder obstruction if present
- Typically responds well to **medical management**

Question #9

- 57-year-old man with spinal cord injury (T12) and a chronic indwelling urinary catheter. Two years prior he had a fever, and his blood grew *S. aureus* and *Pseudomonas*. Urine grew lactose negative GNR and gram-positive organisms.
- One year prior, he again had a fever, and his blood grew *Serratia*, *E. coli*, and *Pseudomonas*. Urine grew *Serratia* and *Pseudomonas*.
- Both times he was treated with appropriate antibiotics, with resolution of fever and stabilization.
- He has had many urine cultures, all of which grew multiple urinary pathogens.
- Prior to entry in a research protocol, he had a screening abdominal ultrasound, which showed a hypoechoic mass in right kidney

In addition to CT scan, what will be the definitive therapy?

- A. Renal biopsy
- B. 3-6 months of antibiotics based on current urine culture
- C. Percutaneous drainage
- D. Nephrectomy

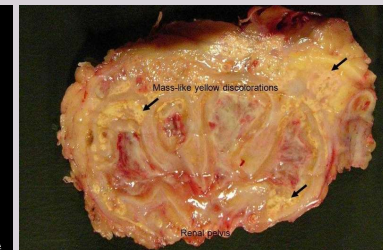
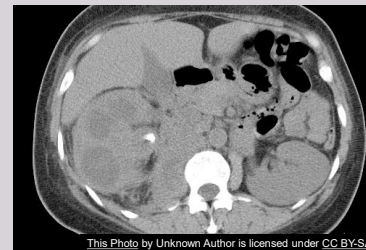
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In addition to CT scan, what will be the definitive therapy?

- A. Renal biopsy
- B. 3-6 months of antibiotics based on current urine culture
- C. Percutaneous drainage
- D. **Nephrectomy*** - can you name the diagnosis?

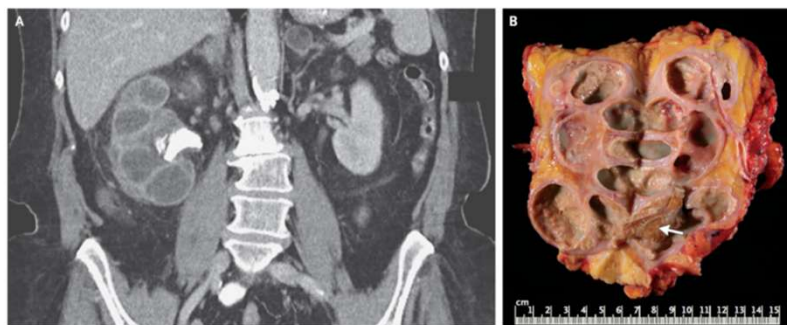
Xanthogranulomatous Pyelonephritis



<https://www.auanet.org/education/auauniversity/education-products-and-resources/pathology-for-urologists/kidney/inflammatory/necrotic-renal-lesions/xanthogranulomatous-pyelonephritis>

Bear Paw Sign

Xanthogranulomatous Pyelonephritis



Marinacci, New England Journal of Medicine 2018; 378:10

Xanthogranulomatous Pyelonephritis

- Chronic polymicrobial infection of renal parenchyma
- Often starts with stone/obstruction
- Frequently insidious and mistaken for tumor
- Renal tissue is destroyed and replaced by granulomatous tissue
- Yellow from the foam cells (macrophages) full of lipids
- **Requires nephrectomy** plus antibiotics
- Our patient underwent right nephrectomy, with finding of a variegated tan-white mass, large amount of inflammatory reaction, purulence in right renal fossa



To Re-Cap

- Acute and recurrent cystitis in women—nitrofurantoin
- Asymptomatic bacteriuria
 - Pregnancy and urologic surgery: screen and treat
 - Everyone else—don't test the urine
- Catheter-associated UTI—ensure drainage
- Complicated UTI—apply the 4 steps
- Pyelonephritis—treat with tissue-active agent
- Urosepsis and worse
 - Emphysematous pyelonephritis—drainage
 - Emphysematous cystitis—medical management
 - Xanthogranulomatous pyelonephritis—removal

Is Everything Clear Now?

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