Antibiotics in Pregnancy and Lactation

(full update May 2024)

The chart below provides information to help guide antibiotic choice during pregnancy and lactation. Most antibiotics are excreted into breast milk in low concentrations.[1] In breastfed infants of patients receiving antibiotics, there is a concern for alteration of infant bowel flora, allergic reactions, and interference of culture result interpretation in the breastfed infant should fever occur.[1] Antibiotics can generally be used during breastfeeding.[22] **Information in chart may differ from product labeling.**

Antibiotic/ Antibiotic Class	Use in Pregnancy	Use in Lactation
Aminoglycosides	Eighth cranial nerve toxicity association with **streptomycin**.[1] **Gentamicin** and **tobramycin** do not appear to be teratogenic, and probably pose a low risk of ototoxicity or nephrotoxicity.[1] "Once-daily" dosing appears to result in higher newborn serum levels in the newborn than "standard" divided dosing.[1] Once-daily dosing not commonly used in obstetrics. No human data available for **plazomicin** (US).[13]	Oral absorption of aminoglycosides is poor, and milk levels of **amikacin**, **gentamicin**, and **tobramycin** are far less than those achieved when treating newborn infections, so systemic effects are not expected in infants.[1,2] There are no human data available, but milk levels of **plazomicin** (US) are expected to be low.[2]
Aztreonam	Limited human data. No problems reported in humans or animals. Use if needed.[1]	Excreted into breast milk in low levels. Oral absorption is poor, so systemic effects are not expected in infants.[1]
Beta-lactamase inhibitors (clavulanate, tazobactam, sulbactam, avibactam [US], durlobactam [US], relebactam [US], vaborbactam [US])	**Clavulanate, sulbactam, and tazobactam**: considered compatible or low risk. There is a case report of necrotizing enterocolitis associated with amoxicillin/clavulanate use near delivery.[1] **Avibactam and vaborbactam**: not teratogenic in rats, or in rabbits at 100 mg/kg. In rabbits at 300 and 1,000 mg/kg, pregnancy loss, lower fetal weight, and some anomalies seen.[15,16] **Relebactam**: increased incidence of cleft palate when given to pregnant mice at dose corresponding to the max recommended human dose.[20]	**Clavulanate, durlobactam, sulbactam, tazobactam, avibactam, and relebactam**: known to be excreted in breast milk in low levels, or expected to be excreted in breast milk.[1,2,15,20] Considered acceptable for use during breastfeeding.[2] **Vaborbactam**: not yet known if excreted in breast milk.[16]

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Antibiotic/ Antibiotic Class	Use in Pregnancy	Use in Lactation
	Durlobactam: in rats and mice, increased risk of skeletal variation at doses corresponding to two to four times the maximum human dose.[21]	
Carbapenems	Human data are limited (most with imipenem-cilastatin), but neither human nor animal data suggest teratogenic risk.[1] Pregnancy loss in monkeys given supratherapeutic doses of imipenem-cilastatin, decreased fetal weight and ossification in mice given supratherapeutic doses of ertapenem, and decrease in fetal weight in rats given supratherapeutic doses of meropenem.[1] Administer if needed.[1]	Known or expected to be excreted into breast milk in low levels that are not expected to cause adverse effects in breastfed infants.[1,2] No reported problems in the few cases available.[1] Imipenem-cilastatin, imipenem-cilastatin-relebactam, and ertapenem are considered acceptable to use during breastfeeding.[2]
Cephalosporins	Not known to be teratogenic.[1,8]	Limited information indicates that cephalosporin levels in milk are low (or expected to be low) and are not anticipated to cause adverse effects in breastfed infants.[2]
Chloramphenicol	Not known to be teratogenic, but there are cases of “gray baby syndrome” when used near term.[1]	Alternative antibiotics are preferred.[2] If chloramphenicol is required, monitor the infant’s complete blood count with differential or discontinue breastfeeding.[2] Based on case reports, monitor for signs of poor feeding and gastrointestinal side effects.[2]
Clindamycin	Conflicting data.[1] A cohort study suggests a small risk of major, musculoskeletal, and ventricular/atrial septal defects, but these findings may be due to confounding or multiple comparisons.[14] Avoid in the first trimester.[1]	An alternate antibiotic may be preferred. However, if necessary to use oral or intravenous clindamycin while breastfeeding, monitor infant for colitis.[2]
Dalbavancin (*Dalvance* [US]; *Xydalba* [Canada])	Limited human data.[1] In rats, treatment with 45 mg/kg/day the human dose was associated with delayed fetal maturation, fetal loss, and offspring death.[4,12]	Dalbavancin is 93% protein bound and poorly absorbed orally. It is not likely to cause any adverse effects in breastfed infants.[2]
Dapsone	Hemolytic anemia, and hyperbilirubinemia when used within a month of delivery, have been reported. No evidence that dapsone is a teratogen. There are also	There is a case of hemolytic anemia in a breastfed newborn.[1] Monitor for signs of hemolysis.[2]

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Antibiotic/ Antibiotic Class	Use in Pregnancy	Use in Lactation
	reports of uneventful use. Some rodent data suggests carcinogenicity. Maternal benefit probably outweighs fetal risk; use if needed.[1]	
Daptomycin	Very limited human data and animal data suggest low risk. Daptomycin's high molecular weight suggests limited placental transfer. Use if needed.[1]	Limited information suggests that daptomycin levels in milk are low and would not be expected to cause any adverse effects in breastfed infants.[2]
Fosfomycin	Has been used in all trimesters. Neither limited human nor animal data suggest teratogenic risk.[1]	Limited information suggests that fosfomycin milk levels are low in milk. Fosfomycin binds to calcium in milk, which limits its absorption. Fosfomycin would not be expected to cause any adverse effects in breastfed infants.[2]
Lefamulin (*Xenleta*)	Avoid use.[1] Animal data indicate fetal loss, stillbirth, death and maturation delays in offspring, reduced fetal weight and ossification, and malformations (e.g., cleft palate, CV malformation).[24,25] A pregnancy registry is available at 855-562-2748 (US).[24]	Lefamulin concentrates in breast milk in lactating rats.[24] Avoid breastfeeding while taking and for two days after the last dose.[2]
Linezolid	Limited human data. Pregnancy loss, reduced fetal weight, and ribcage anomalies seen in animal studies. Use alternative if available.[1]	Excreted into breast milk. A fully breastfed infant could receive as much as 15.61% of the weight-adjusted maternal dose (less than the maximum infant dose). Due to limited data, consider an alternative, especially if nursing a preterm infant or newborm.[2]
Macrolides	Most human data are with erythromycin.[26] Some data suggest macrolide use in the first trimester is associated with CV malformations, especially with **erythromycin**. However, most studies do not suggest risk.[1,17-19,26] **Azithromycin** has not been associated with fetal risk.[1,17,26] **Clarithromycin** is considered low-risk based on human data.[1] Animal data suggest some potential risks (e.g., cleft palate, CV defects, fetal loss, fetal growth restriction).[1]	Because of the low levels of **azithromycin**, **clarithromycin**, and **erythromycin** in breast milk and use in infants in higher doses, it would not be expected to cause adverse effects in breastfed infants.[2] Unconfirmed epidemiologic evidence indicates that the risk of hypertrophic pyloric stenosis in infants might be increased by maternal use of macrolide antibiotics during the first two weeks of breastfeeding.[2]

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Antibiotic/ Antibiotic Class	Use in Pregnancy	Use in Lactation
Metronidazole	Most analyses have failed to demonstrate teratogenic effects.[5-7,27] Some data suggests increased risk of congenital hydrocephaly with first trimester exposure (oral or vaginal).[27] Lab evidence suggests mutagenicity and carcinogenicity, but it may be difficult to establish causality with cancer in humans.[1] Can be used for trichomoniasis or BV, per CDC.[6,7] After topical administration, blood levels are only about 1% of the peak plasma levels after a 250 mg oral dose.[2]	Excretion into breast milk is significant (weight-adjusted infant dose may be as high as 20% of the maternal dose).[5] Cases of candidal infections and diarrhea have been reported.[2] Some clinicians advise deferring breastfeeding for 12 to 24 hours following maternal treatment with a single 2 g dose of metronidazole.[4,6] Topical or vaginal use unlikely to be of concern.[2]
Nitrofurantoin	Evidence mixed, but not a confirmed teratogen.[1,8,17] Acceptable in first trimester when no other alternative is available.[8] Can be used first-line in second and third trimester,[8] but avoid in the last month of pregnancy due to rare hemolytic anemia in the newborn.[1]	Levels in milk are low and it can be used while breastfeeding older infants, but alternate drugs are preferred in patients breastfeeding infants under eight days of age, or infants with G-6-PD deficiency of any age.[2]
Oritavancin (*Orbactiv* [US])	No human data. Animal data does not suggest fetal risk.[1]	Because oritavancin is poorly absorbed orally, it is not likely to cause any adverse effects in breastfed infants. However, because there is no published experience with oritavancin during breastfeeding, an alternate drug may be preferred, especially while nursing a newborn or preterm infant.[2]
Penicillins	Generally considered low risk.[1,17] A small risk of oral clefts with first trimester use of **amoxicillin** or **ampicillin** cannot be excluded. There is a case report of necrotizing enterocolitis associated with amoxicillin/clavulanate use near delivery.[1]	Penicillin levels in milk are low.[2] Diarrhea, thrush, and rash have been reported.[2] Penicillins are considered acceptable to use during breastfeeding.[2]
Quinolones	Animal data suggest quinolones may cause cartilage damage.[1] Most human data is with ciprofloxacin.[1] Various major congenital malformations have been reported in offspring of women taking quinolones during pregnancy.[1,14] Despite no definitive association or pattern, a low risk cannot be excluded, so use of alternatives, especially during the first trimester, is advised.[1]	The calcium in breast milk might reduce absorption.[2] Avoiding breastfeeding for three to four hours after a dose of **ciprofloxacin** or four to six hours after **levofloxacin** or **ofloxacin** should decrease infant exposure. Maternal use of quinolone eye or ear drops presents negligible risk for the nursing infant. To substantially diminish the amount of drug that reaches the breast milk after using eye drops, place pressure over the tear duct by the corner of

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Antibiotic/ Antibiotic Class	Use in Pregnancy	Use in Lactation
		the eye for 1 minute or more, then remove the excess solution with an absorbent tissue.[2]
Quinupristin/ dalfopristin	No human data. Animal data does not suggest toxicity. Use if indicated.[1]	Unlikely to be excreted in breast milk.[2] However, not recommended due to potential for infant to develop resistant strains.[1]
Sulfamethoxazole	Evidence is mixed for **sulfonamides** but they are not confirmed teratogens.[8] Acceptable in first trimester when no other alternative is available.[8] Avoid sulfonamides near delivery (e.g., after 32 weeks) due to a risk of causing high unbound bilirubin levels and kernicterus, or hemolytic anemia in the infant.[9-11]	With healthy, full term infants it appears acceptable to use sulfamethoxazole during breastfeeding **after the newborn period**. Until further data are accumulated, alternate agents should probably be used in jaundiced, ill, stressed, or premature infants, because of the risk of bilirubin displacement and kernicterus. Sulfamethoxazole should be avoided while breastfeeding a G-6-PD-deficient infant.[2]
Tedizolid (*Sivextro* [US])	No human data. Reduced fetal weight and skeletal anomalies seen in animals. Use alternatives if available.[1]	Excreted in breastmilk of rats.[11] The low molecular weight and long half-life suggest it will be excreted into breast milk, but amounts may be limited by high protein binding.[1,2] An alternate drug with more information may be preferred, especially while nursing a newborn or preterm infant.[2]
Telavancin	No human data. There were a few cases of shortened limbs and polydactyly in animal models. Whether this suggests fetal risk is controversial. Alternatives with more data are preferred.[1] A pregnancy registry is available at 855-633-8479 (US).	Because telavancin is poorly absorbed orally, it is not likely to cause any adverse effects in breastfed infants.[2]
Tetracyclines *Continued…*	**Doxycycline**: Most case-control and cohort studies suggest doxycycline is not a human teratogen, nor is there evidence that *in utero* exposure stains "baby teeth." Most exposures in the published literature have been in the first trimester. Animal data does not suggest teratogenicity.[3] A cohort study suggests a small risk of CV defects, but these findings may be due to confounding or multiple	**Doxycycline**, **minocycline**, **tetracycline**: milk levels are low, and absorption may be limited by calcium in breast milk. Avoid prolonged (e.g., >21 days) or repeated exposure due to theoretical risk of dental staining.[2] **Eravacycline**, **omadacycline**: Eravacycline milk levels are likely low due to high protein binding. Omadacycline is poorly absorbed

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Antibiotic/ Antibiotic Class	Use in Pregnancy	Use in Lactation
Tetracyclines, continued	comparisons.[14] Newer evidence suggests first trimester exposure is not associated with major birth defects.[29] **Minocycline**: Little data.[1] **Eravacycline** (US) and **omadacycline** (US): Little human data. May cause reversible inhibition of bone growth and staining of "baby teeth." if taken during the second or third trimester.[23,28] In animals, exposure during organogenesis to levels higher than therapeutic human levels was associated with ossification delay, reduced fetal body weight, pregnancy loss, and malformations (omadacycline).[11] **Tetracycline**: Risk of neural tube defects, cleft palate and other major defects, and maternal hepatotoxicity; may also cause reversible bone growth restriction and staining of "baby teeth."[3] References recommend avoiding in pregnancy, but newer evidence suggests first trimester exposure is not associated with major congenital malformations.[1,29]	orally. Calcium in breast milk might likely inhibit aborption.[2] Nevertheless, the manufacturer recommends avoiding breastfeeding during and for four days after treatment.[23,28]
Tigecycline (structurally similar to tetracycline antibiotics)	No human data. Probably crosses placenta. Not recommended in second or third trimesters due to risk of staining of "baby teeth." Reduction in fetal weight and bone ossification delay in animals.[1]	Tigecycline is poorly absorbed orally, and absorption may be further limited by calcium in breast milk.[1,2] Avoid prolonged (e.g., >21 days) or repeated exposure due to theoretical risk of dental staining.[2]
Tinidazole	Less information than with metronidazole (a related drug). Choose metronidazole over tinidazole if both are options. There was an increase in fetal death in one animal study. Try to avoid in first trimester.[1]	Amounts in breast milk are lower than doses given to infants.[2] Nevertheless, it is advised that breastfeeding should be deferred for three days following maternal treatment with a single dose.[2,7] Candida infection is a theoretical concern based on data for metronidazole.[2]
Trimethoprim	Trimethoprim (a folic acid antagonist) in the first trimester appears to be a teratogen (e.g., neural tube and CV	Trimethoprim levels in milk are low and would not be expected to cause any adverse effects in breastfed infants.[1,2]

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Antibiotic/ Antibiotic Class	Use in Pregnancy	Use in Lactation
	defects) based on animals and human data; avoid in first trimester.[1,9]	
Vancomycin	Not known to be teratogenic.[1]	Excreted in breast milk in low levels, but oral absorption is poor. No special precautions needed.[2]

Abbreviations: AAP = American Academy of Pediatrics; BV = bacterial vaginosis; CV = cardiovascular; CDC = Centers for Disease Control and Prevention

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Managing Genitourinary Menopause Symptoms

The vast majority of females experience symptoms of menopause.[1] These can include vasomotor symptoms (e.g., hot flashes); sleep disturbances; difficulties with mood, memory, or concentration; joint aches and pains; vaginal symptoms (e.g., dryness); and/or urogenital and sexual concerns.[1] The FAQ below answers common questions about managing **genitourinary menopause symptoms**.

Question	Answer/Pertinent Information

What is **genitourinary syndrome of menopause?**	• Symptoms of genitourinary syndrome of menopause (GSM) are caused by lowering estrogen and can include.[3,4]
	  ○ genital: irritation, dryness, burning, itching
	  ○ sexual: dyspareunia (painful intercourse), discomfort
	  ○ urinary: urgency, frequency, recurrent UTIs
	• Help females understand that symptoms are not an "inevitable part of aging." Educate them about treatment options.[5] GSM can have a significant effect on a patient's quality of life, particularly the impact on sexual function.[3,5]

What is the role of **nonhormonal treatments** for managing menopausal vaginal symptoms?	• Nonhormonal treatments are **first-line** for the management of menopausal vaginal symptoms [Evidence Level B-1].[6] They are often effective alone for initial treatment of mild symptoms.[7]
	• **Vaginal lubricants** (e.g., Astroglide, K-Y Jelly) can reduce pain/discomfort (reduces friction during sexual activity).[4]
	  ○ Oil-, water-, and silicone-based products are available.[5]
	  ○ Females may find some products (e.g., those with parabens, glycerin, warming properties, flavors, fragrances, perfumed) irritating to vaginal tissues.[8]
	  ○ Apply to vagina and vulva immediately prior to sexual activity. Reapply as needed.[5]
	• **Vaginal moisturizers** (e.g., Replens, Vagisil) should be used regularly rather than only with sexual activity.[4]
	  ○ These are longer lasting than vaginal lubricants.[5]
	  ○ Apply to vagina and vulva at bedtime, usually two or three times per week.[5]
	• Lubricants and moisturizers provide symptomatic relief but do not generally have an effect on vaginal atrophy.[7]
	• Natural oils (e.g., olive, mineral, coconut) are sometimes used as vaginal lubricants and/or moisturizers.[5] Caution should be used with these as they are associated with an increased risk of vaginal infections.[8]
	• Pelvic floor physical therapy, vaginal dilator therapy, and other "vaginal activity" can improve vulvovaginal health and decrease menopausal vaginal symptoms.[5,7]
	  ○ stimulates, strengthens, and stretches the genital area to promote blood flow, increase natural secretions, and improve muscle tone.[5,7]
	  ○ can include intercourse, masturbation, the use of a vibrator.[5,7-10]

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Question	Answer/Pertinent Information
What is the role of **vaginal estrogens** in the treatment of vaginal symptoms of menopause?	• If nonhormonal treatments are ineffective or inadequate, **second-line** treatment for most patients with moderate to severe menopausal vaginal symptoms is low-dose vaginal estrogen [Evidence Level A-1].[2] • Low-dose vaginal estrogen may be indicated as **initial therapy** in some patients with severe symptoms of vulvovaginal atrophy.[2] It is usually used in addition to nonhormonal therapies (e.g., vaginal moisturizers, lubricant).[7] • Up to 90% of females report subjective improvement in symptoms while on vaginal estrogen therapy.[9] • Low-dose vaginal estrogen works via local effects with minimal systemic absorption, improving symptoms by:[4,5] o decreasing vaginal pH. o improving elasticity and thickness of vulvovaginal tissues. o increasing vaginal secretions and decreasing vaginal dryness. o restoring vaginal blood flow. o reducing the risk of recurrent UTI and potentially reducing symptoms of urgency and frequency. • Improvement in vaginal symptoms is often seen within several weeks of starting low-dose vaginal estrogen, with full effects after two to three months.[5] • The efficacy of low-dose vaginal estrogen appears similar between products.[2,10] The choice is generally based on the patient's preference, convenience, and cost.[5]
Do patients on low-dose vaginal estrogen **need to take a progestogen?**	• The North American Menopause Society states that progestogen therapy is generally not indicated in females using **low-dose** vaginal estrogen; however, data are lacking beyond one year of therapy.[2] Due to lack of data, some product labeling recommends the use of progestins with their products.[11] • Any vaginal bleeding in females using low-dose vaginal estrogens should be investigated.[2]
What is the role of **prasterone** for managing vaginal symptoms of menopause?	• Prasterone vaginal insert (Intrarosa) is an option for moderate to severe dyspareunia of menopausal vulvovaginal atrophy.[12] Prasterone (also called dehydroepiandrosterone or DHEA):[2] o is converted to estrogens and androgens in the vaginal tissues.[12] o increases superficial cells, decreases vaginal pH, and decreases dyspareunia.[7] • Less clinical experience with prasterone compared to vaginal estrogens, and direct comparisons are lacking.[4]
What is the role of **ospemifene** for managing vaginal symptoms of menopause?	• Ospemifene oral tablet (Osphena) is an option for moderate to severe dyspareunia or vaginal dryness of menopausal vulvovaginal atrophy.[7,13] Ospemifene: o is a selective estrogen receptor modulator (SERM) with local estrogenic effects on vaginal tissue (i.e., increases epithelial cells and decreases vaginal pH).[14] o can worsen hot flashes and may increase clotting risk.[13] • There are no direct comparisons of ospemifene to estrogen therapy.[4]

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Question	Answer/Pertinent Information
What is the role of **systemic estrogens** for managing vaginal symptoms of menopause?	• Systemic estrogen therapy is not preferred for most patients with **only** vulvovaginal symptoms of menopause.[2] • Note that some females taking systemic estrogen for vasomotor symptoms of menopause may need additional local estrogen to relieve vaginal symptoms.[4] • The efficacy rates of vaginal estrogens are higher than those of systemic estrogens for the treatment of menopausal vaginal symptoms.[5,9]
What is the role of **oral supplements and natural products** for managing vaginal symptoms of menopause?	• Oral DHEA supplements are not recommended as an alternative to vaginal prasterone (DHEA, Intrarosa) for the treatment of vaginal symptoms of menopause.[2,15] • Evidence is lacking that oral DHEA supplements are effective in the treatment of vaginal symptoms of menopause.[15] • Oral DHEA supplements are absorbed systemically, and concerns have been raised about an increased risk of breast cancer or other hormone-sensitive cancers.[15]

Abbreviations: DHEA = dehydroepiandrosterone; GSM = genitourinary symptoms of menopause; UTI = urinary tract infection.

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In accordance with our goal of providing Evidence-Based information, we are citing the **LEVEL OF EVIDENCE** for the clinical recommendations we publish.

Level	Definition	Study Quality
A	Good-quality patient-oriented evidence.*	1. High-quality randomized controlled trial (RCT) 2. Systematic review (SR)/Meta-analysis of RCTs with consistent findings 3. All-or-none study
B	Inconsistent or limited-quality patient-oriented evidence.*	1. Lower-quality RCT 2. SR/Meta-analysis with low-quality clinical trials or of studies with inconsistent findings 3. Cohort study 4. Case control study
C	Consensus; usual practice; expert opinion; disease-oriented evidence (e.g., physiologic or surrogate endpoints); case series for studies of diagnosis, treatment, prevention, or screening.	

***Outcomes that matter to patients** (e.g., morbidity, mortality, symptom improvement, quality of life).
[Adapted from Ebell MH, Siwek J, Weiss BD, et al. Strength of Recommendation Taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. Am Fam Physician 2004;69:548-56. https://www.aafp.org/pubs/afp/issues/2004/0201/p548.html.]

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Urinary Tract Infections

Modified May 2026

Uncomplicated UTI

Cystitis in men or women. Patient is afebrile (unless fever is due to a non-UTI cause) and has no other symptoms suggesting infection beyond the bladder (see Complicated UTI for these symptoms). Patient does NOT have neurogenic bladder or obstruction.[1]

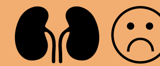
Empiric antibiotic options[8,c]

- TMP or TMP-SMX x 3 days (avoid if resistance >20% or used within 3 months)
- Nitrofurantoin x 5 days or fosfomycin x 1 (avoid if pyelonephritis suspected)
- Alternatives: oral beta-lactam x 3 to 7 days; oral fluoroquinolone x 3 days (see "Complicated UTI" for specific agents)

Symptomatic Treatment (add-on to antibiotic)

- Used for ≤2 days.[2,5] Unclear efficacy.[4,5,7]
- Phenazopyridine poses rare risk of methemoglobinemia, hemolytic anemia, and AKI, often with inappropriate use or G6PD deficiency.[2,3]
- Cystoplus (sodium citrate [Canada]) is a urinary alkalinizer with high sodium content (1,070 mg per dose).[5,6]

Complicated UTI[1]



Pyelonephritis, CAUTI, or UTI associated with neurogenic bladder or obstruction. Symptoms may include fever, chills, rigors, flank pain/tenderness, and/or unstable vitals.

When **choosing an antibiotic**, consider any recent previous culture results, risk of resistance, local antibiograms, and severity of illness.[b] E.coli is the "default" target. Some patients can be treated as outpatients with oral antibiotics.

Empiric antibiotic options

- Preferred: TMP-SMX, ciprofloxacin*, levofloxacin*, piperacillin/tazobactam*, ceftriaxone*, ceftazidime*, cefotaxime*, cefepime*
  - **Consider avoiding fluoroquinolones if the patient has used one in the past 12 months.**
  - Alternatives: amoxicillin/clavulanate,[a] cefixime,[a] cefpodoxime (US),[a] cefuroxime,[a] cephalexin,[a] imipenem/cilastatin,* imipenem/cilastatin/relebactam (US)*, meropenem*, meropenem/vaborbactam*, ertapenem*, ceftolozane/tazobactam*, ceftazidime/avibactam (US)*, cefiderocol (US)*, aminoglycosides*
    ***Sepsis: choose among these.**[b]
- IV to oral **switch**: consider when patient is improving (e.g., afebrile, stable vitals, can take oral meds), provided an effective oral alternative is available and source is controlled.

Duration: For most patients, 7 days (5 to 7 for fluoroquinolones). A longer duration, typically up to 14 days, may be appropriate (e.g., not clinically improving, severe sepsis, immunocompromise, CKD, acute bacterial prostatitis, complete obstruction, surgery, abscess); individualize.

Considerations in Special Populations

Pregnancy

- For pyelonephritis, start with a parenteral agent and treat for a total of 14 days.[9,10] Consider ampicillin/gentamicin, ceftriaxone +/- ampicillin, cefepime, or aztreonam (US) [for beta-lactam allergy]).[9,10] Ampicillin covers enterococcus.[10]
- See our chart, *Antibiotics in Pregnancy and Lactation*, for safety information on fluoroquinolones, nitrofurantoin, TMP-SMX, and more.
- Screen for asymptomatic bacteriuria once, early in pregnancy (e.g., 12 to 16 weeks' gestation or first prenatal visit [USPSTF]; first trimester [Canada]).[12,13] Treat for five to seven days with an appropriate oral antibiotic.[9]

Pediatric

- Be aware that hospital antibiogram data might not apply to pediatric patients.[14]
- Infants <2 months of age are **usually** treated with parenteral antibiotics. Oral antibiotics (after one parenteral dose) might be appropriate if patient is 29 to 60 days of age, looks well, is well-hydrated, has normal labs, has a dependable carer, and will follow up within 24 hours.[15]
- **Empiric options, community**-acquired: cephalexin, ceftriaxone, or nitrofurantoin (cystitis, >12 years of age). Alternatives: TMP-SMX (beta-lactam allergy; history of cefazolin-resistant, TMP-SMX susceptible infection), ciprofloxacin or levofloxacin (beta-lactam allergy).[16,24]
- **Empiric options, hospital**-acquired (CAUTI, extensive antibiotic exposure): cover for *Pseudomonas* (e.g., ceftazidime; alternatives: piperacillin/tazobactam, cefepime, ciprofloxacin, levofloxacin).[16,21,24,25]
- **Phenazopyridine**: A dose of 4 mg/kg/dose (max 200 mg) TID is suggested for children 6 to 11 years of age, but there is no pediatric formulation, and pediatric guidelines do not suggest its use.[7,17]
- **Recurrent UTIs**: reserve antibiotic prophylaxis for some patients with vesicoureteral reflux.[20,24]

Prophylaxis of Recurrent UTIs in Women

- Option for three UTI in a year or two in six months, or >2 during pregnancy.[9,18]
- Non-pharmacologic options: offer cranberry (e.g., 240 mL juice, 500 mg supplement daily); recommend vaginal estrogen (ring, cream) in peri- or postmenopausal women.[18,19]
- Daily antibiotic options: TMP 100 mg, TMP-SMX 40/200 mg (or thrice weekly), nitrofurantoin 50 to 100 mg (an option in pregnancy), cephalexin 125 to 250 mg (an option in pregnancy), fosfomycin 3 g (every 10 days)[9,18]
- Post-coital options: TMP-SMX 40/200 mg, TMP-SMX 80/200 mg, nitrofurantoin 50 to 100 mg (an option in pregnancy), cephalexin 250 mg (an option in pregnancy)[9,18]
- Six to 12 months' duration of antibiotic prophylaxis is evidence-based, but patients often continue for years.[18,26] Assess safety and efficacy periodically.[18]

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Footnotes

a. For **oral beta-lactams**, use highest recommended dose.[1]
b. Sepsis: In sepsis, the initial emphasis is on mortality prevention (vs stewardship). **Consult relevant antibiogram, if available. Choose an antibiotic for which the susceptibilities of the target bacteria are ≥80% (≥90% for SHOCK). Coverage for *Pseudomonas*, MRSA, or enterococci may be appropriate.**
c. Reserve pivmecillinam (US)(Pivya) and sulopenem etzadroxil/probenecid (US)(Orlynvah) for when other options are not feasible (e.g., resistance).[22,23]

Abbreviations: AKI = acute kidney injury; CAUTI = Catheter-associated urinary tract infection; CKD = chronic kidney disease; G6PD = glucose-6-phosphate dehydrogenase; IV = intravenous; MRSA = methicillin-resistant *Staphylococcus aureus*; TID = three times daily; TMP = trimethoprim; TMP-SMX = trimethoprim/sulfamethoxazole; UTI = urinary tract infection

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