

### Fluoroquinolones

The fluoroquinolones are bacteriocidal and affect DNA synthesis by inhibiting two bacterial enzymes: DNA gyrase and topoisomerase IV. Clinical applications of fluoroquinolones include infections of the respiratory, GI, and genitourinary tracts, and some skin and soft-tissue infections. Their effectiveness against gram-negative organisms makes them preferred drugs for the treatment of uncomplicated UTIs.

Drug	Route and Adult Dose
<b>FIRST GENERATION</b>	
nalidixic acid (NegGram)	PO; Acute therapy: 1 g qid
<b>SECOND GENERATION</b>	
 ciprofloxacin (Cipro)	PO; 250–750 mg bid (max: 1,500 mg/day) IV; 200–400 mg every 12 h
norfloxacin (Noroxin)	PO; 400 mg bid or 800 mg once daily
ofloxacin (Floxin)	PO; 200–400 mg bid (max: 800 mg/day)
<b>THIRD GENERATION</b>	
gatifloxacin (Zymar, Zymaxid)	Ophthalmic solution; one drop eye every 2–6 h
levofloxacin (Levaquin)	PO; 250–500 mg/day (max: 750 mg/day) IV; 250–750 mg/day
<b>FOURTH GENERATION</b>	
besifloxacin (Besivance)	Ophthalmic solution; one drop eye every 8 h
gemifloxacin (Factive)	PO; 320 mg/day (max: 320 mg/day)
moxifloxacin (Avelox, Moxeza, Vigamox)	PO/IV (Avelox); 400 mg/day (max: 400 mg/day)

**Adverse effect**

- ❖ Nausea, diarrhea, vomiting, rash, headache, restlessness,
- ❖ pain and inflammation at the injection site,
- ❖ corneal irritation (ophthalmic)
- ❖ Anaphylaxis,
- ❖ tendon rupture,
- ❖ pseudomembranous colitis,
- ❖ seizure,
- ❖ peripheral neuropathy,
- ❖ hepatotoxicity.

**Drug interactions**

Several drug interactions may occur with the fluoroquinolones.

- Administration with antacids that contain magnesium or aluminum hydroxide results in decreased absorption of the fluoroquinolone.
- Some fluoroquinolones, such as ciprofloxacin, norfloxacin, and ofloxacin, interact with aminophylline and theophylline, increasing their plasma level and the risk of toxicity.
- Giving ciprofloxacin or norfloxacin with probenecid results in decreased kidney elimination of these fluoroquinolones, increasing their serum levels and half-life.

**Sulfonamides**

Sulfonamides are bacteriostatic and active against a broad spectrum of microorganisms. Sulfonamides suppress bacterial growth by inhibiting the synthesis of folic acid, or folate.

Drug	Route and Adult Dose (max dose where indicated)
<b>SULFONAMIDES</b>	
sulfadiazine	PO; Loading dose: 2–4 g; Maintenance dose: 2–4 g/day in four to six divided doses  Topical: apply 1% silver sulfadiazene to cover the affected area
sulfadoxine–pyrimethamine	PO; 1 tablet weekly (500 mg sulfadoxine, 25 mg pyrimethamine)
sulfisoxazole (Gantrisin)	PO; 2–4 g initially, followed by 1–2 g qid (max: 12 g/day)
trimethoprim –sulfamethoxazole (SMZ) (Bactrim, Septra)	PO; 160 mg TMP, 800 mg SMZ bid IV: 8–10 mg/kg/day TMP, every 6–12 h infused over 60–90 min

**Adverse effect**

- ❖ Nausea, vomiting, anorexia, rash, photosensitivity,
- ❖ crystalluria
- ❖ Anaphylaxis,
- ❖ Stevens–Johnson syndrome,
- ❖ Blood dyscrasias,
- ❖ fulminant hepatic necrosis,
- ❖ Hyperkalemia.

**Drug interactions**

Sulfonamides have few significant interactions.

- They increase the hypoglycemic effects of the sulfonylureas (oral antidiabetic drugs), which may decrease blood glucose levels.
- Co-trimoxazole may increase the anticoagulant effect of coumarin anticoagulants.
- Co-trimoxazole and methotrexate may cause increased methotrexate levels and increase the risk of toxicity.

**Lincomycin derivatives**

This group include lincomycin and clindamycin, used for many gram-positive and anaerobic organisms, because of their high potential for causing serious adverse effects, they are prescribed only when there's no therapeutic alternative . Clindamycin and lincomycin inhibit bacterial protein synthesis by inhibiting the binding of bacterial ribosomes.

**Adverse reactions**

- Pseudomembranous colitis (characterized by severe diarrhea, abdominal pain, fever, and mucus and blood in stool) ,this syndrome can be fatal and requires prompt discontinuation of the drug as well as aggressive fluid and electrolyte management.
  - diarrhea
  - stomatitis (mouth inflammation)
  - nausea and vomiting
  - hypersensitivity reactions

**Vancomycin hydrochloride**

Vancomycin hydrochloride is used increasingly to treat methicillin-resistant *S. aureus*, because of the emergence of vancomycin-resistant enterococci, vancomycin must be used judiciously. As a rule of thumb, it should be used only when culture and sensitivity test results confirm the need for it. Vancomycin inhibits bacterial cell-wall synthesis, damaging the bacterial plasma membrane.

**Note:** Because vancomycin is absorbed poorly from the GI tract, it must be given I.V. to treat systemic infections. However, an oral form of vancomycin is used to treat pseudomembranous colitis.

### **Monobactams**

Aztreonam is the first member in the class of monobactam antibiotics and the only one currently available. Aztreonam's bactericidal activity results from inhibition of bacterial cell-wall synthesis. It binds to the PBP-3 of susceptible gram-negative bacterial cells, inhibiting cell-wall division and resulting in lysis.

Aztreonam is indicated in a range of therapeutic situations:

- It's effective against a wide variety of gram-negative aerobic organisms, including *P. aeruginosa*.
- It's effective against most strains of the following organisms: *E. coli*, *Enterobacter*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *H. influenzae*.
- It's also used to treat complicated and uncomplicated UTIs, septicemia, and lower respiratory tract, skin and skin-structure, intra-abdominal, and gynecologic infections caused by susceptible gram-negative aerobic bacteria.

### **Carbapenems**

Carbapenems are a class of beta-lactam antibacterials that includes:

- ertapenem
- imipenem-cilastatin sodium (a combination drug)
- meropenem.

Imipenem-cilastatin, ertapenem, and meropenem are bactericidal. They exert antibacterial activity by inhibiting bacterial cell-wall synthesis.

### **Nitrofurantoin**

Nitrofurantoin is used to treat acute and chronic UTIs. It isn't useful in treating pyelonephritis or perinephric (around the kidney) diseases.