ANTIBIOTICS

QUICK REFERRENCE CHART:

Infection or illness	Antibiotic most used	Drug Interaction or Side effects
Anthrax	Tetracycline	YES – See notes below
Bladder Kidney infections	Amoxicillin	Yes to both – See Notes-- allergies to Penicillin may be an issue
Bronchitis	Cephalexin	No interactions/ some side effects allergies to Penicillin may be an issue
Bronchitis	Penicillin	Yes to both – See Notes -- allergies to Penicillin may be an issue
Colon Problems Bloody diarrhea	Metronidazole	YES —side effects rare See other notes
Cholera	Tetracycline	YES – See notes below
Dysentery	Metronidazole	YES —side effects rare See other notes
Ear Infection	Cephalexin	No interactions/ some side effects allergies to Penicillin may be an issue
Ear Infection	Amoxicillin	Yes to both – See Notes-- allergies to Penicillin may be an issue
E-Coli	Ciprofloxacin	YES – See note below
E-Coli	Amoxicillin	Yes to both – See Notes -- allergies to Penicillin may be an issue
Infectious Diarrheas	Ciprofloxacin	YES – See note below
Influenza	Amoxicillin	Yes to both – See Notes -- allergies to Penicillin may be an issue
Pelvic Inflammation	Metronidazole	YES —side effects rare See other notes
Pneumonia	Cephalexin	No interactions/ some side effects allergies to Penicillin may be an issue
Pneumonia	Penicillin	Yes to both – See Notes --allergies to Penicillin may be an issue
Respiratory Tract Infections	Tetracycline	YES – See notes below
Rocky Mountain spotted fever	Tetracycline	YES – See notes below
Salmonella	Amoxicillin	Yes to both – See Notes -- allergies to Penicillin may be an issue
Sinus Infection	Amoxicillin	Yes to both – See Notes-- allergies to Penicillin may be an issue
Stomach Ulcers	Metronidazole	YES —side effects rare See other notes
Throat infection Strep Infection	Penicillin	Yes to both – See Notes -- allergies to Penicillin may be an issue
Tonsils Soar throat	Cephalexin	No interactions/ some side effects allergies to Penicillin may be an issue
Typhus	Tetracycline	YES – See notes below
Urinary tract	Tetracycline	YES – See notes below
Urinary tract	Ciprofloxacin	YES – See notes below
Vaginal infections	Metronidazole	YES —side effects rare See other notes

GENERIC NAME: Ampicillin // Amoxicillin

PRESCRIBED FOR: Ampicillin is used for treating infections of the middle ear, sinuses, stomach and intestines, bladder, and kidney caused by susceptible bacteria. It also is used for treating uncomplicated gonorrhea, meningitis, endocarditis and other serious infections.

DRUG CLASS AND MECHANISM: Ampicillin belongs to a class of antibiotics called penicillins that are used for treating bacterial infections. Other members of this class include amoxicillin (Amoxil), piperacillin (Pipracil), ticarcillin (Ticar) and several others. These antibiotics all have a similar mechanism of action. They stop bacteria from multiplying by preventing bacteria from forming the walls that surround them. The walls are necessary to protect bacteria from their environment and to keep the contents of the bacterial cell together. Bacteria cannot survive without a cell wall. Penicillins are most effective when bacteria are actively multiplying and forming cell walls. Ampicillin is effective against many bacteria including *H. influenzae, N. gonorrhoea, E. coli, Salmonella, and Shigella, streptococci* and certain strains of *staphylococci*. Ampicillin was approved by the FDA in 1963.

STORAGE: Capsules and powder should be kept at room temperature between 15 C (59 F) and 30 C (86 F). After mixing the powder with water, it can be used for up to seven days if stored at room temperature or 14 days if refrigerated. It must be shaken before each use and should be kept well-sealed.

DOSING: The usual oral dose range for most infections is 250 to 500 mg 4 times daily for 7-14 days. When used to treat gonorrhea, a single 3.5 gram dose (seven 500 mg capsules) is administered with probenecid (Benemid). The probenecid slows down the elimination of ampicillin so that ampicillin remains in the body longer. Food in the stomach reduces how much and how quickly ampicillin is absorbed. Therefore, ampicillin should be taken either 1 hour prior to or 2 hours following a meal for maximal absorption; however, for persons who experience nausea or stomach distress after taking ampicillin, it may be taken with meals.

DRUG INTERACTIONS: Probenecid (Benemid) causes an increase in the amount of ampicillin in the body. Use of ampicillin with allopurinol (Zyloprim) can increase the incidence of drug-related skin rash.

SIDE EFFECTS: Common side effects of ampicillin include nausea, vomiting, loss of appetite, diarrhea, abdominal pain, rash, itching, headache, confusion and dizziness. Patients with a history of allergic reactions to other penicillins should not receive ampicillin. Persons who are allergic to the cephalosporin class of antibiotics, which are related to the penicillin, for example, cefaclor (Ceclor), cephalexin (Keflex), and cefprozil (Cefzil), may or may not be allergic to penicillin. Serious but rare reactions include seizures, severe allergic reactions (anaphylaxis), and low platelet or red blood cell count. Ampicillin can alter the normal bacteria in the colon and encourage overgrowth of some bacteria such as *Clostridium difficile* which causes inflammation of the colon (pseudomembranous colitis). Patients who develop signs of pseudomembranous colitis after starting ampicillin (diarrhea, fever, abdominal pain, and possibly shock) should contact their physician immediately.

GENERIC NAME: Cephalexin

PRESCRIBED FOR: Cephalexin is used to treat infections caused by bacteria that are susceptible to the effects of cephalexin. Common infections that are treated with cephalexin include infections of the middle ear, tonsils, throat, larynx (laryngitis), bronchi (bronchitis) and pneumonia. It also is used for treating urinary tract, skin, and bone infections.

DRUG CLASS AND MECHANISM: Cephalexin belongs to a class of antibiotics called cephalosporins. They are similar to penicillin in action and side effects. They stop or slow the growth of bacterial cells by preventing bacteria from forming the cell wall that surrounds each cell. The cell wall protects bacteria

from the external environment and keeps the contents of the cell together. Without a cell wall, bacteria are not able to survive. Bacteria that are susceptible to cephalexin include *Staphylococcus aureus, Streptococcus pneumoniae, Haemophilus influenzae, E. coli* and several others. Cephalexin was approved by the FDA in January 1971.
STORAGE: Tablets and capsules should be stored at room temperature, 15-30°C (59-86°F). Suspensions should be refrigerated and discarded after 14 days.
DOSING: The dose of cephalexin for adults is 1 to 4 grams in divided doses. Children are treated with 25-100 mg/kg/day in divided doses. The dosing interval may be every 6 or 12 hours depending on the infection.

DRUG INTERACTIONS: Serious interactions of cephalexin with other drugs are uncommon.

SIDE EFFECTS: The most common side effects of cephalexin are diarrhea, nausea, abdominal pain, vomiting, headaches, dizziness, skin rash, fever, abnormal liver tests and vaginitis. Individuals who are allergic to penicillin may also be allergic to cephalexin. Cephalexin, like almost all antibiotics, may cause mild or severe cases of pseudomembranous colitis, a mild to severe inflammation of the colon. Antibiotics, including cephalexin alter the normal flora of the colon and permit overgrowth of a bacterium called *Clostridium difficile*. Studies indicate that a toxin produced by *Clostridium difficile* is a primary cause of pseudomembranous colitis.

GENERIC NAME: Ciprofloxacin

PRESCRIBED FOR: Ciprofloxacin is used to treat infections of the skin, lungs, airways, bones, and joints caused by susceptible bacteria. Ciprofloxacin is also frequently used to treat urinary infections caused by bacteria such as E. coli. Ciprofloxacin is effective in treating infectious diarrheas caused by E. coli, *Campylobacter jejuni*, and *Shigella bacteria*.

DRUG CLASS AND MECHANISM: Ciprofloxacin is an antibiotic that is used to treat bacterial infections. Ciprofloxacin stops the multiplication of bacteria by inhibiting the reproduction and repair of their genetic material (DNA). The FDA approved ciprofloxacin in October 1987.
STORAGE: Immediate release tablets: store below 30C (86F). Extended release tablets: store between 15-30C (59-86F). Microcapsules: store below 25C (77F) and protect from freezing. Injection: Store between 5-30C (41-86F) and avoid freezing.
DOSING: For most infections the recommended oral dose for adults is 250-750 mg (immediate release tablets) every 12 hours or 500-1000 mg (extended release tablets) every 24 hours. The usual intravenous dose is 200-400 mg every 8-12 hours.

DRUG INTERACTIONS: Ciprofloxacin administered together with theophylline can lead to elevated, toxic blood levels of theophylline. Theophylline is used to open airways in the treatment of asthma. Toxic levels of theophylline can lead to seizures, and disturbances in heart rhythm. If concurrent use of ciprofloxacin and theophylline cannot be avoided, frequent blood tests to monitor theophylline blood levels are recommended. Iron salts (for example, ferrous sulfate) may reduce the absorption of ciprofloxacin because of formation of a ciprofloxacin-iron complex that is not absorbable. Antacids also may reduce the absorption of ciprofloxacin. If patients are receiving iron salts or antacids and ciprofloxacin, the ciprofloxacin should be given two hours before or six ours after the iron salt or antacid. Ciprofloxacin may increase the blood thinning effect of warfarin (Coumadin). The reason for this is unknown. Anticoagulant activity should be monitored after starting or stopping ciprofloxacin. Sevelamer (Renagel) may reduce the absorption of ciprofloxacin and possibly reduce the effectiveness of ciprofloxacin. Milk and orange juice also may reduce the absorption of ciprofloxacin. Ciprofloxacin, as with iron and antacids, should be given two hours before or six ours after milk or orange juice.

SIDE EFFECTS: The most frequent side effects of ciprofloxacin include nausea, vomiting, diarrhea, abdominal pain, rash, headache, and restlessness. Rare allergic reactions have been described, such as hives and anaphylaxis (shock). Ciprofloxacin should be used with caution in patients with central nervous system diseases such as seizures, because rare seizures have been reported in patients receiving ciprofloxacin. Ciprofloxacin should be avoided in children and adolescents less than 18 years of age, as safe use in these patients has not been established.

Many antibiotics, including ciprofloxacin, can alter the normal bacteria in the colon and encourage overgrowth of a bacterium responsible for the development of inflammation of the colon (pseudomembranous colitis). Patients who develop signs of pseudomembranous colitis after starting ciprofloxacin (diarrhea, fever, abdominal pain, and possibly shock) should contact their physician. Patients taking ciprofloxacin can develop sensitivity of the skin to direct sunlight (photosensitivity) and should avoid exposure to sunlight or use sun protection and sunscreens. Ciprofloxacin as well as other antibiotics in the fluoroquinolone class of antibiotics, has been associated with tendinitis and even rupture of tendons, particularly the Achilles tendon. Some physicians recommend that their patients discontinue vigorous exercise while they are taking fluoroquinolone antibiotics.

GENERIC NAME: Metronidazole

PRESCRIBED FOR: Metronidazole is used to treat parasitic infections including Giardia infections of the small intestine, amebic liver abscess and amebic dysentery (infection of the colon causing bloody diarrhea), bacterial vaginosis, trichomonas vaginal infections, and carriers of trichomonas (both sexual partners) who do not have symptoms of infection. Metronidazole is also used alone or in combination with other antibiotics in treating abscesses in the liver, pelvis, abdomen and brain caused by susceptible anaerobic bacteria. Metronidazole is also used in treating infection of the colon caused by a bacterium called *C. difficile*. (Many commonly-used antibiotics can alter the type of bacteria that inhabit the colon. *C. difficile* is an anaerobic bacterium that can infect the colon when the normal types of bacteria in the colon are inhibited by common antibiotics. This leads to inflammation of the colon (pseudomembranous colitis) with severe diarrhea and abdominal pain.) Metronidazole also is used in combination with other drugs to treat Helicobacter pylori (*H. pylori*) that causes stomach or intestinal ulcers. Metronidazole topical gel is used for treating acne rosacea, and the vaginal gel is used for treating bacterial vaginosis.

DRUG CLASS AND MECHANISM: Metronidazole is an antibiotic effective against anaerobic bacteria and certain parasites. Anaerobic bacteria are single-celled, living organisms that thrive in environments in which there is little oxygen (anaerobic environments) and can cause disease in the abdomen (bacterial peritonitis), liver (liver abscess), and pelvis (abscess of the ovaries and the Fallopian tubes). Giardia lamblia and ameba are intestinal parasites that can cause abdominal pain and diarrhea in infected individuals. Trichomonas is a vaginal parasite that causes inflammation of the vagina (vaginitis). Metronidazole selectively blocks some of the functions within the bacterial cells and the parasites resulting in their death.
STORAGE: Metronidazole should be stored at room temperature and protected from light.
DOSING: Metronidazole may be taken orally with or without food. In the hospital, metronidazole can be administered intravenously to treat serious infections. The liver is primarily responsible for eliminating metronidazole from the body, and doses may need to be reduced in patients with liver disease and abnormal liver function. Various metronidazole regimens are used. Some examples are listed below.

Amebic dysentery: 750 mg orally 3 times daily for 5-10 days

Amebic liver abscess: 500-750 mg orally three times daily for 5-10 days

Anaerobic infections: 7.5 mg/kg orally every 6 hours not to exceed 4 grams daily

Bacterial Vaginosis: 750 mg (extended release tablets) once daily for 7 days. One applicator-full of 0.75% vaginal gel, once or twice daily for 5 days.

Clostridium difficile infection: 250-500 mg orally 4 times daily or 500-750 orally 3 times daily

Giardia: 250 mg orally three times daily for 5 days

Helicobacter pylori: 800-1500 mg orally daily for several days in combination with other drugs.

Pelvic inflammatory disease (PID): 500 mg orally twice daily for 14 days in combination with other drugs.

Trichomoniasis: 2 g single dose or 1 g twice

Rosacea: apply topical gel 0.75-1% once daily

DRUG INTERACTIONS: Alcohol should be avoided because metronidazole and alcohol together can cause severe nausea, vomiting, cramps, flushing, and headache. Metronidazole can increase the blood thinning effects of warfarin (Coumadin) and increase the risk of bleeding probably by reducing the break down of warfarin. Cimetidine (Tagamet) increases blood levels of metronidazole while cholestyramine reduces blood levels of metronidazole by reducing its absorption. Metronidazole should not be combined with amprenavir for treating human immunodeficiency disease (infection with HIV) because amprenavir contains propylene glycol. Metronidazole blocks the breakdown of propylene glycol in the liver leading to accumulation of propylene glycol in blood. Accumulation of propylene glycol could cause seizures, increased heart rate, and lead to kidney failure. Metronidazole increases the blood levels of carbamazepine, lithium and cyclosporine though unknown mechanisms. Serious reactions may occur if these drugs are taken with metronidazole.

SIDE EFFECTS: Metronidazole is a valuable antibiotic and is generally well tolerated with appropriate use. Minor side effects include nausea, headaches, loss of appetite, a metallic taste, and rarely a rash. Serious side effects of metronidazole are rare. Serious side effects include seizures and damage of nerves resulting in numbness and tingling of extremities (peripheral neuropathy). Metronidazole should be stopped if these symptoms appear.

GENERIC NAME: Penicillin V

PRESCRIBED FOR: Oral penicillin V is effective against susceptible bacteria causing throat infections, laryngitis, bronchitis, and pneumonia. Only mild to moderate infections are treated with oral penicillin. Patients with more severe infections can be given penicillin by injection (intramuscular "shots" or intravenously). Penicillin also is given to prevent infection on the valves of the heart in patients with certain diseases of the heart valves who are having dental work or undergoing gastrointestinal endoscopic procedures. (Dental work and some endoscopic procedures can introduce bacteria into the blood, and these bacteria may infect the valves.)

DRUG CLASS AND MECHANISM: In 1928, Alexander Fleming noted that mold belonging to the genus *Penicillium*, inhibited the growth of bacteria. Fleming called this unknown antibacterial substance penicillin. Ten years later, a group at Oxford University began to investigate the material in laboratory mice. Penicillin was hailed as a miracle drug and saved countless lives in World War II. Today, many derivatives of penicillin have been developed which inhibit more types of bacteria than this original, life-saving drug. Penicillin itself is active against Streptococci (including *Streptococcus pneumoniae*), Listeria, *Neisseria gonorrhoeae*, Clostridium, Peptococcus, and Peptostreptococcus. Most staphylococci now are resistant to penicillin.

STORAGE: Tablets should be kept between 15°C (59 °F) and 30°C (86°F). The solution should be kept

refrigerated, and can be used for up to 14 days after it is reconstituted by the pharmacist. It must be shaken before each use and should be kept well sealed.
DOSING: Penicillin V is ideally given 30 to 60 minutes before meals, but can be given with meals to persons who develop nausea or stomach pain with it. Penicillin is most often given four times a day for 7 to 14 days. When given to prevent infections in persons undergoing dental or gastrointestinal procedures, penicillin is given as one dose one hour prior to the procedure, and one more dose is given 6 hours later.

DRUG INTERACTIONS: Probenecid (Benemid) causes an increase in the level of penicillin in the blood by reducing the elimination of penicillin by the kidneys. In fact, sometimes probenecid is combined with penicillin so that a smaller amount of penicillin results in higher blood levels.

SIDE EFFECTS: Penicillin generally is well tolerated. Between 1% and 10% of all people are allergic to penicillin. Allergic reactions range from a mild rash to moderate-to-severe hives to severe anaphylactic shock. (In anaphylactic shock, the windpipe swells so that breathing is difficult and the blood pressure falls greatly. Anaphylactic shock is a life-threatening emergency that requires immediate treatment.) Anaphylactic shock occurs in approximately 1 in 3,000 persons who are exposed to penicillin; death occurs in approximately 1 in 50,000 persons who are exposed to penicillin. Persons who are allergic to other penicillin products (such as ampicillin or amoxicillin) are generally considered to be allergic to penicillin as well. Persons who are allergic to the cephalosporin class of antibiotics (e.g., Ceclor, Keflex, Cefzil) may or may not be allergic to penicillins.

GENERIC NAME: Tetracycline

PRESCRIBED FOR: Tetracycline is used for treating several types of infections caused by susceptible bacteria. Some examples include infections of the respiratory tract, urinary tract, and skin. It also is prescribed for nongonococcal urethritis, Rocky Mountain spotted fever, typhus, chancroid, cholera, brucellosis, anthrax, syphilis, and acne. It is used in combination with other medications to treat *Helicobacter pylori*, the bacteria associated with ulcers and inflammation of the stomach and duodenum.

DRUG CLASS AND MECHANISM: Tetracycline is an antibiotic with a broad spectrum, that is, it is active against many different bacteria. It is effective against *Hemophilus influenzae*, *Streptococcus pneumoniae*, *Mycoplasma pneumoniae*, *Chlamydia psittaci, Chlamydia trachomatis, Neisseria gonorrhoeae*, and many others. Tetracycline prevents growth of bacteria by preventing the bacteria to manufacture proteins that they need to survive. The first drug of the tetracycline family, chlortetracycline, was introduced in 1948.
STORAGE: Tetracycline should be stored below 30 C (86 F).
DOSING: Food reduces the absorption of tetracycline. Therefore, tetracycline should be taken at least two hours before or after meals. For most infections, tetracycline is taken two to four times daily for 7 to 14 days. The usual adult dose is 1-2 g/day in 2 or 4 divided doses.

DRUG INTERACTIONS: Tetracycline should not be taken at the same time as aluminum, magnesium, or calcium-based antacids [for example, aluminum with magnesium hydroxide-oral (Mylanta, Maalox), calcium carbonate (Tums, Rolaids)]; iron supplements; bismuth subsalicylate (Pepto-Bismol), and dairy products. These agents bind tetracycline in the intestine and reduce its absorption into the body.

Tetracycline may enhance the activity of the blood thinner, warfarin (Coumadin), and result in excessive "thinning" of the blood, necessitating a reduction in the dose of warfarin. Phenytoin (Dilantin), carbamazepine (Tegretol), and barbiturates (such as phenobarbital) may enhance the elimination of tetracycline. Tetracycline may reduce the effectiveness of oral contraceptives.

SIDE EFFECTS: Tetracycline is generally well-tolerated. The most common side effects are diarrhea or loose stools, nausea, abdominal pain, rash, and vomiting. Headache and dizziness may also occur. Tetracycline may cause discoloration of teeth if used in patients below 8 years of age. Exaggerated sunburn can occur with tetracycline (photosensitivity). Therefore, sunlight or sunlamp exposure should be minimized during treatment.

NOTE Fifteen years ago, the Pentagon and the Food and Drug Administration set out to determine if prescription drugs continue to be effective after the expiration date stamped on the bottle. At that time the military was sitting on $1 billion worth of expired drugs and was contemplating the need to destroy them and replace them with fresh stockpiles every two or three years.

- The results, never before reported, show that about 90 percent of them were safe and effective far beyond their original expiration date.

"It turns out that the expiration date on a drug does stand for something, but probably not what you think it does. Since a law was passed in 1979, drug manufacturers are required to stamp an expiration date on their products. This is the date at which the manufacturer can still guarantee the full potency and safety of the drug.

Most of what is known about drug expiration dates comes from a study conducted by the Food and Drug Administration at the request of the military. With a large and expensive stockpile of drugs, the military faced tossing out and replacing its drugs every few years. What they found from the study is 90% of more than 100 drugs, both prescription and over-the-counter, were perfectly good to use even 15 years after the expiration date.

So the expiration date doesn't really indicate a point at which the medication is no longer effective or has become unsafe to use. Medical authorities state expired drugs are safe to take, even those that expired years ago. A rare exception to this may be tetracycline, but the report on this is controversial among researchers. It's true the effectiveness of a drug may decrease over time, but much of the original potency still remains even a decade after the expiration date. Excluding nitroglycerin, insulin, and liquid antibiotics, most medications are as long-lasting as the ones tested by the military. Placing a medication in a cool place, such as a refrigerator, will help a drug remain potent for many years." -- www. health.Harvard.edu/