Cephalosporins

Cephalosporins are similar to penicillins. They are more expensive but are useful for people who cannot tolerate penicillins. Cephalosporins are organized into four generations, based on their activity: First-generation cephalosporins such as cefazolin (Ancef, Kefzol) and cefadroxil are used mainly for patients who are allergic to penicillin. They act against gram-positive bacteria such as group B streptococci, which can cause pneumonia. Second-generation cephalosporins such as cefprozil and cefuroxime (Zinacef) are commonly used to treat **nosocomial** (infection acquired in a health-care facility) pneumonia and pelvic or intra-abdominal infections. Third-generation cephalosporins such as ceftriaxone (Rocephin) and ceftizoxime (Cefizox) act against gram-negative bacteria such as *Escherichia coli* (*E. coli*), a common cause of intestinal illnesses. Fourth-generation cephalosporins such as cefepime (Maxipime) are given by the IV route for severe nosocomial surgical infections.

This group of medications is used to both treat and prevent infections in many patients. The use of alcohol or alcohol-containing substances should be avoided during treatment because of associated abdominal side effects.

A CLOSER LOOK 17.2: Drug-Resistant Bacteria

Sometimes a specific bacterium is resistant to antibiotics and is therefore difficult to treat. Resistance to antibiotics occurs when a bacterium becomes weakened but does not die. The bacterium may then develop an ability to resist this antibiotic the next time it is given. This situation occurs when a medication is not taken for the full time it is ordered. Examples of drug-resistant bacteria that may be encountered are methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Staphylococcus aureus* (VRSA), and vancomycin-resistant *Enterococcus* (VRE).

Tetracyclines

Tetracyclines were commonly used during the 1950s and 1960s, but many bacteria have since become resistant to them. The main function of this class of medication is to prevent bacteria from making protein (protein synthesis), which interrupts the reproduction of bacteria. Tetracyclines such as doxycycline (Vibramycin), minocycline (Solodyn), and tetracycline (achromycin V) are useful against both gram-negative and gram-positive microbes that cause bacterial infections such as gonorrhea, chlamydia, anthrax, and urinary tract infections. These medications are not used in children or pregnant women because permanent staining occurs on the teeth of the child or fetus.

Macrolides

Macrolides such as erythromycin (E.E.S. Granules, Ery-Tab, Erythrocin Stearate Filmtab), clarithromycin (Biaxin), and azithromycin (Zithromax, Zithromax Z-Pak) are prescribed both orally and by injection for infections that are resistant to penicillins. These drugs function by inhibiting the bacterium's protein synthesis. These classes of medications are used for upper and lower respiratory tract infections, skin infections, pertussis, diphtheria, pelvic inflammatory disease, syphilis, Legionnaires' disease, strep throat, sinus infections, chronic bronchitis, pneumonia, and otitis media.

Aminoglycosides

Aminoglycosides such as amikacin (Amikin), gentamicin (Cidomycin, Garamycin, Septopal), kanamycin (Kantrex), neomycin (Mycifradin, Neo-Fradin, Neo-Tab), paromomycin (Humatin, Paromycin), and tobramycin (Nebcin, Tobi) are more toxic than other antibiotics. They are ideal against aerobic gram-negative bacteria such as *Pseudomonas,* which require oxygen to grow, mycobacteria (tuberculosis), and some protozoans, which are one-celled organisms. Aminoglycosides are administered topically via ointments, eye or ear drops, or as an IV injection. Patients taking aminoglycosides systemically should have blood levels of the antibiotic monitored periodically for efficacy and toxicity. These medications are used only when no other suitable anti-infective is available, because of the risks for damage to the patient's hearing and kidney function.