

Ceftazidime (Systemic)

Antibacterial; β -lactam antibiotic; third generation cephalosporin.

Class: Third Generation Cephalosporins 8:12.06.12 (AHFS primary); AM103 (VA primary)

Brands: Fortaz[®]; Tazicef[®]

Uses

Bone and Joint Infections

- Treatment of bone and joint infections caused by susceptible *Staphylococcus aureus* (oxacillin-susceptible strains only) *Klebsiella*, or *Pseudomonas aeruginosa*.

Intra-abdominal and Gynecologic Infections

- Treatment of gynecologic infections (including endometritis, pelvic cellulitis, other infections of the female genital tract) caused by susceptible *Escherichia coli*.
- Treatment of intra-abdominal infections (including peritonitis) caused by susceptible *S. aureus* (oxacillin-susceptible strains only), *E. coli*, or *Klebsiella*.
- Treatment of polymicrobial intra-abdominal infections caused by susceptible aerobic and anaerobic bacteria and *Bacteroides*. Consider that many strains of *B. fragilis* are resistant; generally should not be used alone in serious intra-abdominal infections when this organism may be involved.

Meningitis and Other CNS Infections

- Treatment of meningitis caused by susceptible *H. influenzae*, *Neisseria meningitidis*, *Ps. aeruginosa*, or *Streptococcus pneumoniae* in adults or children.
- Ceftazidime in conjunction with an aminoglycoside considered a regimen of choice for treatment of meningitis caused by susceptible *P. aeruginosa* or susceptible *Enterobacteriaceae*† (e.g., *E. coli*, *P. mirabilis*, *Enterobacter*, *S. marcescens*).
- Cefotaxime or ceftriaxone generally preferred when a third generation cephalosporin is indicated for treatment of meningitis caused by *H. influenzae*, *N. meningitidis*, or *S. pneumoniae*.

Respiratory Tract Infections

- Treatment of respiratory tract infections (including pneumonia) caused by susceptible *S. aureus* (oxacillin-susceptible [methicillin-susceptible] strains only), *S. pneumoniae*, *Citrobacter*, *Enterobacter*, *E. coli*, *Klebsiella*, *Proteus mirabilis*, *Pseudomonas* (including *Ps. aeruginosa*), or *Serratia*.

Septicemia

- Treatment of septicemia caused by susceptible *S. aureus* (oxacillin-susceptible strains only), *S. pneumoniae*, *Haemophilus influenzae*, *E. coli*, *Klebsiella*, *Ps. aeruginosa*, or *Serratia*.

Skin and Skin Structure Infections

- Treatment of skin and skin structure infections caused by susceptible *S. aureus* (oxacillin-susceptible strains only), *S. pyogenes* (group A β -hemolytic streptococci), *Enterobacter*, *E. coli*, *Klebsiella*, *Proteus* (including *P. mirabilis*), *Ps. aeruginosa*, or *Serratia*.

Urinary Tract Infections (UTIs)

- Treatment of uncomplicated and complicated UTIs caused by susceptible *Enterobacter*, *E. coli*, *Klebsiella*, *Proteus* (including *P. mirabilis*), *Ps. aeruginosa*, or *Serratia*.

Burkholderia Infections

- Treatment of septicemia or pulmonary infections caused by *Burkholderia cepacia*† (formerly *Ps. cepacia*); alone or in conjunction with an aminoglycoside. Co-trimoxazole considered drug of choice; ceftazidime, chloramphenicol, or imipenem are alternatives.
- Treatment of severe melioidosis†, caused by *B. pseudomallei* (formerly *Ps. pseudomallei*). A drug of choice. *B. pseudomallei* is difficult to eradicate (relapse of melioidosis is common) and resistant strains of *B. pseudomallei* have developed during ceftazidime therapy.

Otitis Externa

- Treatment of malignant otitis externa† caused by *Ps. aeruginosa*.
- Acute bacterial otitis externa localized in the external auditory canal may be effectively treated using topical anti-infectives (e.g., otic preparations of ciprofloxacin or ofloxacin), but malignant otitis externa is an invasive, potentially life-threatening infection (especially in immunocompromised patients such as those with diabetes

mellitus or HIV infection) and requires prompt diagnosis and long-term treatment with parenteral anti-infectives (e.g., ceftazidime and/or ciprofloxacin).

Pseudomonas aeruginosa Infections

- Generally considered a drug of choice for treatment of infections caused by *Ps. aeruginosa*, including acute exacerbations of bronchopulmonary *Ps. aeruginosa* infections in children and adults with cystic fibrosis.
- In severe infections, especially in immunocompromised patients, concomitant use of ceftazidime and an aminoglycoside (e.g., amikacin, gentamicin, tobramycin) is recommended. Consider that ceftazidime-resistant strains of *Ps. aeruginosa* can emerge during therapy and superinfection with resistant strains has occurred.
- Anti-infective therapy in patients with cystic fibrosis may result in clinical improvement and *Ps. aeruginosa* may be temporarily cleared from the sputum, but a bacteriologic cure is rarely obtained and should not be expected.

Vibrio Infections

- Treatment of infections caused by *Vibrio vulnificus*†.
- Optimum anti-infective therapy has not been identified; a tetracycline or third generation cephalosporin (e.g., cefotaxime, ceftazidime) is recommended. Because the case fatality rate associated with *V. vulnificus* is high, initiate anti-infective therapy promptly if indicated.

Empiric Therapy in Febrile Neutropenic Patients

- Empiric treatment of presumed bacterial infections in febrile neutropenic adults or children†. Has been used alone or in conjunction with an aminoglycoside (e.g., amikacin, gentamicin, tobramycin).
- Consider that gram-positive bacteria have become a predominant pathogen in febrile neutropenic patients and that ceftazidime is less active against gram-positives than many other cephalosporins and β -lactam antibiotics. An anti-infective active against staphylococci (e.g., vancomycin) probably should be used concomitantly if ceftazidime is used for empiric therapy.
- Consult published protocols for the treatment of infections in febrile neutropenic patients for specific recommendations regarding selection of the initial empiric regimen, when to change the initial regimen, possible subsequent regimens, and duration of therapy in these patients. Consultation with an infectious disease expert knowledgeable about infections in immunocompromised patients also is advised.

Perioperative Prophylaxis

- Has been used for perioperative prophylaxis† in patients undergoing vaginal hysterectomy, intra-abdominal surgery, or transurethral resection of the prostate.
- Other cephalosporins or cephamycins (cefazolin, cefotetan, cefoxitin) are preferred drugs for perioperative prophylaxis. Ceftazidime and other third generation cephalosporins usually not used for perioperative prophylaxis since they are expensive, some are less active against staphylococci than cefazolin, they have a spectrum of activity wider than necessary for organisms encountered in elective surgery, and their use for prophylaxis promotes emergence of resistant organisms.

Dosage and Administration

Administration

Administer by intermittent IV injection or infusion or by deep IM injection. Also has been administered by continuous IV infusion†.

Has been administered intraperitoneally in dialysis solutions. *Should not be administered by intra-arterial injection since arteriospasm and necrosis can occur.*

IV route preferred for treatment of septicemia, meningitis, peritonitis, or other severe or life-threatening infections and in patients with lowered resistance resulting from malnutrition, trauma, surgery, diabetes, heart failure, or malignancy, particularly if shock is present or impending.

The commercially available frozen ceftazidime injection in dextrose should be used only for IV infusion.

IV Injection

Reconstitution

For intermittent IV injection, reconstitute Fortaz[®] vials containing 500 mg, 1 g, or 2 g with 5, 10, or 10 mL, respectively, of sterile water for injection to provide solutions containing approximately 100, 95–100, or 170–180 mg/mL, respectively.

For intermittent IV injection, reconstitute Tazicef[®] vial containing 1 g with 3 mL of sterile water for injection to provide a solution containing approximately 280 mg/mL.

Shake vial after adding the diluent; carbon dioxide is released as drug dissolves and the solution will become clear within 1–2 minutes. When withdrawing a dose from reconstituted vials, consider that the solution may contain some carbon dioxide bubbles which should be expelled from the syringe before injection.

Rate of Administration

Inject appropriate dose of reconstituted solution into a vein over a period of 3–5 minutes or slowly into the tubing of a compatible IV solution.

IV Infusion**Reconstitution and Dilution**

Reconstitute vials of Fortaz[®] or Tazicef[®] containing 1 or 2 g of ceftazidime with 100 mL of sterile water for injection or compatible IV solution. Shake the vial after adding the diluent; carbon dioxide is released as the drug dissolves and the solution will become clear within 1–2 minutes. The appropriate dose of the drug should then be added to a compatible IV solution.

Reconstitute piggyback units of Fortaz[®] containing 1 or 2 g of ceftazidime with 100 mL of sterile water for injection or a compatible IV solution to provide a solution containing 10 or 20 mg/mL, respectively. Add the diluent in 2 stages; carbon dioxide is released as the drug dissolves (generating pressure within the container) and the solution will become clear within 1–2 minutes. A vent needle should then be inserted into the piggyback unit to release the pressure; to preserve sterility, it is important that the vent needle be inserted through the vial closure only after the drug has dissolved. The vent needle should be removed after the diluent has been added; any additional pressure that may develop in the unit (especially after storage) should be relieved prior to administration.

Reconstitute pharmacy bulk packages according to the manufacturer's directions and then further dilute in a compatible IV infusion solution prior to administration.

ADD-Vantage[®] vials labeled as containing 1 or 2 g of ceftazidime should be reconstituted according to the manufacturer's directions.

Thaw the commercially available injection (frozen) at room temperature or in a refrigerator; do *not* force thaw by immersion in a water bath or by exposure to microwave radiation. A precipitate may have formed in the frozen injection, but should dissolve with little or no agitation after reaching room temperature. Discard thawed injection if an insoluble precipitate is present or if container seals or outlet ports are not intact. The injection should not be used in series connections with other plastic containers, since such use could result in air embolism from residual air being drawn from the primary container before administration of fluid from the secondary container is complete.

Rate of Administration

Intermittent IV infusions generally have been infused over 15–30 minutes in adults, neonates, and children.

If a Y-type administration set is used, the other solution flowing through the tubing should be discontinued while ceftazidime is being infused.

IM Injection

IM injections should be made deeply into a large muscle mass, such as the upper outer quadrant of the gluteus maximus or lateral part of the thigh.

Reconstitution

IM injections of Fortaz[®] are prepared by adding 1.5 or 3 mL of sterile or bacteriostatic water for injection or 0.5 or 1% lidocaine hydrochloride injection to vials containing 500 mg or 1 g of ceftazidime, respectively, to provide solutions containing approximately 280 mg/mL.

IM injections of Tazicef[®] are prepared by adding 3 mL of sterile water for injection to a vial labeled as containing 1 g of the drug to provide a solution containing approximately 280 mg/mL.

Shake the vial after adding the diluent; carbon dioxide is released as the drug dissolves and the solution will become clear within 1–2 minutes. When withdrawing a dose from reconstituted vials, consider that the solution may contain some carbon dioxide bubbles which should be expelled from the syringe before injection.

Intraperitoneal Instillation

Reconstitute with sterile water for injection as for IV infusion and then further dilute in a compatible peritoneal dialysis solution to provide a solution containing 250 mg of ceftazidime in each 2 L of dialysis solution.

Dosage

Available as ceftazidime pentahydrate and as ceftazidime sodium; dosage expressed as anhydrous ceftazidime.

Pediatric Patients**General Pediatric Dosage in Neonates**

IV: Neonates ≤ 4 weeks of age: manufacturer recommends 30 mg/kg every 12 hours.

Neonates < 1 week of age: AAP recommends 50 mg/kg every 12 hours in those weighing ≤ 2 kg and 50 mg/kg every 8 or 12 hours in those weighing > 2 kg.

Neonates 1–4 weeks of age: AAP recommends 50 mg/kg every 12 hours in those weighing < 1.2 kg and 50 mg/kg every 8 hours in those weighing ≥ 1.2 kg.

General Pediatric Dosage in Children 1 Month to 12 Years of Age

IV: 25–50 mg/kg every 8 hours.

50 mg/kg every 8 hours in immunocompromised children or children with cystic fibrosis or meningitis.

General Pediatric Dosage in Children > 12 Years of Age

IV: Use usual adult dosage. (See Adult Dosage under Dosage and Administration.)

Empiric Therapy in Febrile Neutropenic Children†

IV: 50 mg/kg (maximum 2 g) every 8 hours has been used in pediatric patients ≥ 2 years of age.

Adults**General Adult Dosage****>Less Severe Infections**

IV or IM: 1 g every 8–12 hours.

>Severe or Life-threatening Infections

IV: 2 g every 8 hours, especially in immunocompromised patients.

Bone and Joint Infections

IV: 2 g every 12 hours.

Intra-abdominal and Gynecologic Infections**>Serious Infections**

IV: 2 g every 8 hours.

Meningitis

IV: 2 g every 8 hours. Duration of treatment is ≥ 3 weeks for meningitis caused by susceptible gram-negative bacilli.

Respiratory Tract Infections**>Uncomplicated Pneumonia**

IV or IM: 0.5–1 g every 8 hours.

>Pseudomonas Lung Infections in Cystic Fibrosis Patients

IV: 30–50 mg/kg every 8 hours (up to 6 g daily).

Clinical improvement may occur, but bacteriologic cures should not be expected in patients with chronic respiratory disease and cystic fibrosis.

Skin and Skin Structure Infections**>Mild Infections**

IV or IM: 0.5–1 g every 8 hours.

Urinary Tract Infections (UTIs)**>Uncomplicated Infections**

IV or IM: 250 mg every 12 hours.

>Complicated Infections

IV or IM: 500 mg every 8–12 hours.

Prescribing Limits**Pediatric Patients**

Maximum 6 g daily.

Adults

Maximum 6 g daily.

Special Populations**Hepatic Impairment**

Dosage adjustments not required unless renal function also impaired.

Renal Impairment

Reduce dosage in patients with $Cl_{cr} \leq 50$ mL/minute.

Manufacturers recommend that adults with $Cl_{cr} \leq 50$ mL/minute receive an initial loading dose of 1 g and a maintenance dosage based on Cl_{cr} . (See Table.)

Maintenance Dosage for Adults with Renal Impairment:

Cl_{cr} (mL/minute)	Dosage
31–50	1 g every 12 h
16–30	1 g every 24 h
6–15	500 mg every 24 h
< 5	500 mg every 48 h

Patients with renal impairment and severe infections who would generally receive 6 g daily if renal function were normal: increase dosage in table by 50% or dosing interval may be increased appropriately.

Patients undergoing hemodialysis: given an initial loading dose of 1 g followed by 1 g after each hemodialysis period.

Patients undergoing intraperitoneal dialysis or CAPD: given an initial loading dose of 1 g followed by 500 mg every 24 hours.

Geriatric Patients

Cautious dosage selection because of age-related decreases in renal function. (See Renal Impairment under Dosage and Administration.)

Cautions**Contraindications**

- Known hypersensitivity to ceftazidime or other cephalosporins.

Warnings/Precautions

Warnings

Superinfection/Clostridium difficile-associated Colitis

Possible emergence and overgrowth of nonsusceptible organisms with prolonged therapy. Careful observation of the patient is essential. Institute appropriate therapy if superinfection occurs.

Treatment with anti-infectives may permit overgrowth of clostridia. Consider *Clostridium difficile*-associated diarrhea and colitis (antibiotic-associated pseudomembranous colitis) if diarrhea develops and manage accordingly.

Some mild cases of *C. difficile*-associated diarrhea and colitis may respond to discontinuance alone. Manage moderate to severe cases with fluid, electrolyte, and protein supplementation; appropriate anti-infective therapy (e.g., oral metronidazole or vancomycin) recommended if colitis is severe.

Neurotoxicity

Possibility of seizures, encephalopathy, coma, asterixis, neuromuscular excitability, and myoclonia if inappropriately high dosage used in patients with renal impairment. (See Renal Impairment under Cautions.)

Sensitivity Reactions

Hypersensitivity Reactions

Possible hypersensitivity reactions, including rash (maculopapular or erythematous), pruritus, fever, eosinophilia, urticaria, anaphylaxis, erythema multiforme, Stevens-Johnson syndrome, and toxic epidermal necrolysis.

If an allergic reaction occurs, discontinue and institute appropriate therapy as indicated (e.g., epinephrine, corticosteroids, maintenance of an adequate airway and oxygen).

Cross-hypersensitivity

Partial cross-sensitivity among cephalosporins and other β -lactam antibiotics, including penicillins and cephamycins.

Prior to initiation of therapy, make careful inquiry concerning previous hypersensitivity reactions to cephalosporins, penicillins, or other drugs. Cautious use recommended in individuals hypersensitive to penicillins: avoid use in those who have had an immediate-type (anaphylactic) hypersensitivity reaction and administer with caution in those who have had a delayed-type (e.g., rash, fever, eosinophilia) reaction.

General Precautions

History of GI Disease

Use with caution in patients with a history of GI disease, particularly colitis. (See Superinfection/Clostridium difficile-associated Colitis under Cautions.)

Prolonged PT

Possibility of prolonged PT.

Monitor PT in patients at risk, including those with renal or hepatic impairment, poor nutritional state, receiving prolonged therapy, or stabilized on anticoagulant therapy. Administer vitamin K when indicated.

Selection and Use of Anti-infectives

To reduce development of drug-resistant bacteria and maintain effectiveness of ceftazidime and other antibacterials, use only for treatment or prevention of infections proven or strongly suspected to be caused by susceptible bacteria.

When selecting or modifying anti-infective therapy, use results of culture and in vitro susceptibility testing. In the absence of such data, consider local epidemiology and susceptibility patterns when selecting anti-infectives for empiric therapy.

Resistance in Gram-negative Bacteria

Resistance caused by inducible type I β -lactamases can develop in some gram-negative bacilli (e.g., *Enterobacter*, *Pseudomonas*, *Serratia*) during treatment, leading to clinical failure in some cases.

When treating infections caused by these bacteria, perform periodic in vitro susceptibility testing when clinically appropriate. If patient fails to respond to monotherapy, an aminoglycoside or similar agent should be considered.

Risk of Distal Necrosis

Possibility of distal necrosis after inadvertent intra-arterial administration.

Sodium Content

Vials, pharmacy bulk packages, and ADD-Vantage® vials contain ceftazidime admixed with sodium carbonate to facilitate dissolution. These preparations contain approximately 54 mg (2.3 mEq) of sodium per g of ceftazidime.

Specific Populations

Pregnancy

Category B.

Lactation

Distributed into milk in low concentrations; use with caution.

Geriatric Use

No overall differences in safety and efficacy in those ≥ 65 years of age compared with younger adults, but the possibility of increased sensitivity in some geriatric individuals cannot be ruled out.

Substantially eliminated by kidneys; risk of toxicity may be greater in those with impaired renal function. Select dosage with caution and assess renal function periodically because of age-related decreases in renal function. (See Renal Impairment under Dosage and Administration.)

Hepatic Impairment

Pharmacokinetics not affected.

Renal Impairment

Possible decreased clearance and increased serum half-life.

Neurotoxicity reported in some patients with renal impairment who received dosage inappropriately high for their renal status. (See Neurotoxicity under Cautions.)

Dosage adjustments necessary in patients with $Cl_{cr} \leq 50$ mL/minute. See Renal Impairment under Dosage and Administration.

Common Adverse Effects

GI effects, hypersensitivity reactions, local reactions at IV injection sites.

Interactions

Specific Drugs and Laboratory Tests

Drug or Test	Interaction	Comments
Aminoglycosides	Nephrotoxicity reported with concomitant use of some cephalosporins and aminoglycosides In vitro evidence of additive or synergistic antibacterial activity against <i>Pseudomonas</i> and Enterobacteriaceae	Carefully monitor renal function, especially if high aminoglycoside dosage is used or if therapy is prolonged
Chloramphenicol	In vitro evidence of antagonism against gram-negative bacilli	Avoid concomitant use
Probenecid	No appreciable effect on pharmacokinetics of ceftazidime	
Tests for glucose	Possible false-positive reactions in urine glucose tests using Clintest®, Benedict's solution, or Fehling's solution	Use glucose tests based on enzymatic glucose oxidase reactions (e.g., Clinistix®, Tes-Tape®)

Pharmacokinetics

Absorption

Bioavailability

Not absorbed from GI tract; must be given parenterally.

Following IM administration, peak serum concentrations attained in approximately 1 hour. May be absorbed more slowly in women than in men following IM injection into the gluteus maximus or vastus lateralis. In women, peak serum concentrations may be lower following IM injection into the gluteus maximus than into the vastus lateralis.

In patients with end-stage chronic renal failure who receive a single dose of the drug via an intraperitoneal catheter, peak serum concentrations attained 2.75 hours after the dose.

Distribution

Extent

Widely distributed into body tissues and fluids including the gallbladder, bone, bile, skeletal muscle, prostatic tissue, endometrium, myometrium, heart, skin, adipose tissue, aqueous humor, and sputum, and pleural, peritoneal, synovial, ascitic, lymphatic, and blister fluids.

Generally diffuses into CSF following IV administration; CSF concentrations higher in patients with inflamed meninges than in those with uninfamed meninges.

Distributed into bile, but biliary concentrations following IM or IV administration may be lower than concurrent serum concentrations.

Crosses the placenta and is distributed into milk.

Plasma Protein Binding

5–24%.

Elimination

Metabolism

Not metabolized.

Elimination Route

Eliminated unchanged principally in urine by glomerular filtration.
80–90% of a dose eliminated in urine within 24 hours.

Half-life

Adults with normal renal and hepatic function: distribution half-life 0.1–0.6 hours and elimination half-life 1.4–2 hours.

Neonates: 2.2–4.7 hours.

Children 1–12 months of age: 2 hours.

Special Populations

Patients with impaired hepatic function: serum half-life only slightly prolonged.

Patients with impaired renal function: serum concentrations higher and serum half-life prolonged. Serum half-life ranges from 9.4–10.3 hours in those with Cl_{cr} 13–27 mL/minute and 11–35 hours in those with Cl_{cr} <10 mL/minute.

Stability

Storage**Parenteral****Powder for Injection or Infusion**

15–30° C; protect from light.

Powder for injection and solutions may darken; does not indicate loss of potency.

Reconstituted IV solutions prepared using sterile water, IV solutions that have been further diluted to 1–40 mg/mL in a compatible IV solution, and IV solutions prepared from ADD-Vantage* are stable for 24 hours at room temperature or 7 days under refrigeration.

IM solutions containing 280 mg/mL prepared using sterile or bacteriostatic water or 0.5 or 1% lidocaine hydrochloride are stable for 24 hours at room temperature or 7 days under refrigeration.

Injection (Frozen) for Infusion

–20° C or lower. After thawing, store up to 24 hours at room temperature (25° C) or up to 7 days under refrigeration.

Do not refreeze after thawing.

Compatibility

For information on systemic interactions resulting from concomitant use, see Interactions.

Parenteral**Solution Compatibility**

Less stable in sodium bicarbonate injection than in other IV solutions; sodium bicarbonate not recommended as a diluent.

Compatible

Amino acids 5%, dextrose 25%	Ringer's injection
Dextrose 5% in sodium chloride 0.2, 0.45, or 0.9%	Ringer's injection, lactated Sodium bicarbonate 4.2%
Dextrose 5 or 10% in water	Sodium chloride 0.9%
Invert sugar 10% in water	Sodium lactate $\frac{1}{6}$ M
Normosol M in dextrose 5%	

Drug Compatibility**>Admixture Compatibility****Compatible**

Clinدامycin phosphate	Metronidazole
Fluconazole	Ofloxacin
Linezolid	

Incompatible

Amikacin sulfate	Gentamicin sulfate
Aminophylline	Ranitidine HCl
Ciprofloxacin	

Variable

Ciprofloxacin

>Y-Site Compatibility**Compatible**

Acylovir sodium	Aztreonam
Allopurinol sodium	Bivalirudin
Amifostine	Ciprofloxacin
Amikacin sulfate	Dexmedetomidine HCl
Aminophylline	Diltiazem HCl

Docetaxel	Labetalol HCl
Doxapram HCl	Linezolid
Enalaprilat	Melphalan HCl
Esmolol HCl	Meperidine HCl
Etoside phosphate	Milrinone lactate
Famotidine	Morphine sulfate
Fenoldopam mesylate	Ondansetron HCl
Filgrastim	Paclitaxel
Fludarabine phosphate	Propofol
Foscarnet sodium	Ranitidine HCl
Furosemide	Remifentanyl HCl
Gatifloxacin	Sufentanil citrate
Gemcitabine HCl	Tacrolimus
Gentamicin sulfate	Teniposide
Granisetron HCl	Theophylline
Heparin sodium	Thiotepa
Hetastarch in lactated electrolyte injection (Hextend)	Tobramycin sulfate
Hydromorphone HCl	Vinorelbine tartrate
Ketamine HCl	Zidovudine

Incompatible

Amiodarone HCl	Idarubicin HCl
Amphotericin B cholesteryl sulfate complex	Midazolam HCl
Amsacrine	Pentamidine isethionate
Azithromycin	Propofol
Doxorubicin HCl liposome injection	Vancomycin HCl
Erythromycin lactobionate	Warfarin sodium
Fluconazole	

Variable

Nicardipine HCl	Vancomycin HCl
Sargramostim	

Actions and Spectrum

- Based on spectrum of activity, classified as a third generation cephalosporin. Usually less active in vitro against susceptible staphylococci than first generation cephalosporins; has an expanded spectrum of activity against gram-negative bacteria compared with first and second generation cephalosporins.
- Usually bactericidal.
- Like other β -lactam antibiotics, antibacterial activity results from inhibition of bacterial cell wall synthesis.
- Spectrum of activity includes many gram-positive aerobic bacteria, some gram-negative aerobic bacteria, and some anaerobic bacteria; inactive against *Chlamydia*, fungi, and viruses.
- Spectrum of activity of ceftazidime resembles that of ceftizoxime, cefotaxime, and ceftriaxone. However, ceftazidime more active against *Pseudomonas* than most other currently available parenteral third generation cephalosporins and less active against anaerobes and gram-positive aerobic cocci than these drugs.
- Gram-positive aerobes: active in vitro and in clinical infections against *S. aureus* (including β -lactamase-producing strains), *S. pneumoniae*, *S. pyogenes* (group A β -hemolytic streptococci), and *S. agalactiae* (group B streptococci). Oxacillin-resistant (methicillin-resistant) staphylococci and enterococci (e.g., *Enterococcus faecalis*) are resistant.
- Gram-negative aerobes: active in vitro and in clinical infections against *Citrobacter* (including *C. freundii*, *C. diversus*), *Enterobacter* (including *E. aerogenes*, *E. cloacae*), *E. coli*, *H. influenzae* (including ampicillin-resistant strains), *Klebsiella* (including *K. pneumoniae*), *Neisseria meningitidis*, *Proteus mirabilis*, *P. vulgaris*, *Pseudomonas* (including *Ps. aeruginosa*), and *Serratia*. Also active in vitro against *Acinetobacter*, *H. parainfluenzae*, *Morganella morganii*, *N. gonorrhoeae*, *Providencia* (including *P. rettgeri*), *Salmonella*, *Shigella*, and *Yersinia enterocolitica*.
- Anaerobes: active in vitro and in clinical infections against *Bacteroides*; many strains of *B. fragilis* are resistant. Also active in vitro against *Clostridium* (except *C. difficile*), *Peptococcus*, and *Peptostreptococcus*.

Advice to Patients

- Advise patients that antibacterials (including ceftazidime) should only be used to treat bacterial infections; they do not treat viral infections (e.g., the common cold).
- Importance of completing full course of therapy, even if feeling better after a few days.
- Advise patients that skipping doses or not completing the full course of therapy may decrease effectiveness and increase the likelihood that bacteria will develop resistance and will not be treatable with ceftazidime or other antibacterials in the future.

- Importance of informing clinicians if an allergic reaction occurs.
- Importance of women informing clinician if they are or plan to become pregnant or plan to breast-feed.
- Importance of informing clinicians of existing or contemplated concomitant therapy, including prescription and OTC drugs.
- Importance of informing patients of other important precautionary information. (See Cautions.)

Preparations

Ceftazidime

Parenteral

For injection	equivalent to anhydrous ceftazidime 500 mg (with sodium carbonate)	Fortaz [®] , GlaxoSmithKline
	equivalent to anhydrous ceftazidime 1 g (with sodium carbonate)	Fortaz [®] , GlaxoSmithKline Tazicef [®] , Abbott
	equivalent to anhydrous ceftazidime 2 g (with sodium carbonate)	Fortaz [®] , GlaxoSmithKline Tazicef [®] , Abbott
	equivalent to anhydrous ceftazidime 6 g pharmacy bulk package (with sodium carbonate)	Fortaz [®] , GlaxoSmithKline Tazicef [®] , Abbott
For injection, for IV infusion	equivalent to anhydrous ceftazidime 1 g (with sodium carbonate)	Fortaz [®] ADD-Vantage [®] , GlaxoSmithKline Fortaz [®] Infusion Pack , GlaxoSmithKline Tazicef [®] ADD-Vantage [®] , Abbott Tazicef [®] Piggyback , Abbott
	equivalent to anhydrous ceftazidime 2 g (with sodium carbonate)	Fortaz [®] ADD-Vantage [®] , GlaxoSmithKline Fortaz [®] Infusion Pack , GlaxoSmithKline Tazicef [®] ADD-Vantage [®] , Abbott Tazicef [®] Piggyback , Abbott

Ceftazidime Sodium in Dextrose

Parenteral

Injection (frozen), for IV infusion	equivalent to 20 mg (of anhydrous ceftazidime) per mL (1 g in 4.4% dextrose)	Fortaz [®] in Iso-osmotic Dextrose Injection (Galaxy [®] [Baxter]), GlaxoSmithKline Tazicef [®] in Iso-osmotic Dextrose Injection (Galaxy [®] [Baxter]), Abbott
	equivalent to 40 mg (of anhydrous ceftazidime) per mL (2 g in 3.2% dextrose)	Fortaz [®] in Iso-osmotic Dextrose Injection (Galaxy [®] [Baxter]), GlaxoSmithKline Tazicef [®] in Iso-osmotic Dextrose Injection (Galaxy [®] [Baxter]), Abbott

[†]Use is not currently included in the labeling approved by the US Food and Drug Administration