

changed in the urine within 24 hours. It is removed by haemodialysis and peritoneal dialysis.

#### Cystic fibrosis. References.

1. Leeder JS, et al. Ceftazidime disposition in acute and stable cystic fibrosis. *Clin Pharmacol Ther* 1984; **36**: 355–62.
2. Hedman A, et al. Influence of the glomerular filtration rate on renal clearance of ceftazidime in cystic fibrosis. *Clin Pharmacokinet* 1988; **15**: 57–65.
3. Vinks AATMM, et al. Continuous infusion of ceftazidime in cystic fibrosis patients during home treatment: clinical outcome, microbiology and pharmacokinetics. *J Antimicrob Chemother* 1997; **40**: 125–33.

#### The elderly. References.

1. LeBel M, et al. Pharmacokinetics of ceftazidime in elderly volunteers. *Antimicrob Agents Chemother* 1985; **28**: 713–15.
2. Higbee MD, et al. Pharmacokinetics of ceftazidime in elderly patients. *Clin Pharm* 1989; **8**: 59–62.
3. Sirgo MA, Norris S. Ceftazidime in the elderly: appropriateness of twice-daily dosing. *DICP Ann Pharmacother* 1991; **25**: 284–8.

#### Hepatic impairment. References.

1. El Touny M, et al. Pharmacokinetics of ceftazidime in patients with liver cirrhosis and ascites. *J Antimicrob Chemother* 1991; **28**: 95–100.

#### Neonates. References.

1. van den Anker JN, et al. Ceftazidime pharmacokinetics in preterm infants: effects of renal function and gestational age. *Clin Pharmacol Ther* 1995; **58**: 650–9.
2. van den Anker JN, et al. Ceftazidime pharmacokinetics in preterm infants: effect of postnatal age and postnatal exposure to indomethacin. *Br J Clin Pharmacol* 1995; **40**: 439–43.
3. van den Anker JN, et al. Once-daily versus twice-daily administration of ceftazidime in the preterm infant. *Antimicrob Agents Chemother* 1995; **39**: 2048–50.

#### Renal impairment. References.

1. Welage LS, et al. Pharmacokinetics of ceftazidime in patients with renal insufficiency. *Antimicrob Agents Chemother* 1984; **25**: 201–4.
2. Leroy A, et al. Pharmacokinetics of ceftazidime in normal and uremic subjects. *Antimicrob Agents Chemother* 1984; **25**: 638–42.
3. Ackerman BH, et al. Effect of decreased renal function on the pharmacokinetics of ceftazidime. *Antimicrob Agents Chemother* 1984; **25**: 785–6.
4. Lin N-S, et al. Single- and multiple-dose pharmacokinetics of ceftazidime in infected patients with varying degrees of renal function. *J Clin Pharmacol* 1989; **29**: 331–7.
5. Kinowski J-M, et al. Multiple-dose pharmacokinetics of amikacin and ceftazidime in critically ill patients with septic multiple-organ failure during intermittent hemofiltration. *Antimicrob Agents Chemother* 1993; **37**: 464–73.
6. Demotes-Mainard F, et al. Pharmacokinetics of intravenous and intraperitoneal ceftazidime in chronic ambulatory peritoneal dialysis. *J Clin Pharmacol* 1993; **33**: 475–9.

#### Uses and Administration

Ceftazidime is a third-generation cephalosporin antibacterial with enhanced activity against *Pseudomonas aeruginosa*. It is used in the treatment of susceptible infections especially those due to *Pseudomonas* spp. They include biliary-tract infections, bone and joint infections, cystic fibrosis (respiratory-tract infections), endophthalmitis, infections in immunocompromised patients (neutropenic patients), melioidosis, meningitis, peritonitis, pneumonia, upper respiratory-tract infections, septicæmia, skin infections (including burns, ecthyma gangrenosum, and ulceration), and urinary-tract infections. It is also used for surgical infection prophylaxis. For details of these infections and their treatment, see under Choice of Antibacterial, p.162.

**Administration and dosage.** Ceftazidime is available as the pentahydrate but it is formulated with sodium carbonate, to form the sodium salt in solution, or with arginine. Doses are expressed in terms of anhydrous ceftazidime; ceftazidime pentahydrate 1.16 g is equivalent to about 1 g of anhydrous ceftazidime. It is given by deep intramuscular injection, slow intravenous injection over 3 to 5 minutes, or intravenous infusion over up to 30 minutes. The usual dose for adults ranges from 1 to 6 g daily in divided doses every 8 or 12 hours. The higher doses are used in severe infections especially in immunocompromised patients. In adults with cystic fibrosis who have pseudomonas lung infections, high doses of 90 to 150 mg/kg daily in 3 divided doses are used; up to 9 g daily has been given to those with normal renal function. Single doses of more than 1 g should be given intravenously.

Children are usually given ceftazidime 30 to 100 mg/kg daily in 2 or 3 divided doses, but in severely

ill children up to 150 mg/kg daily to a maximum of 6 g daily (9 g in cystic fibrosis with pseudomonas lung infection) may be given in 3 divided doses. Neonates and infants up to 2 months have been given 25 to 60 mg/kg daily in 2 divided doses.

In the elderly the dose should generally not exceed 3 g daily.

Although not licensed for nebulisation in the UK, the *BNFC* suggests a dose of 1 g inhaled twice daily for the management of chronic *Burkholderia cepacia* (*Pseudomonas cepacia*) infection in patients aged 1 month and older with cystic fibrosis.

For details of reduced doses in patients with renal impairment, see below.

For surgical infection prophylaxis in patients undergoing prostatic surgery, a dose of 1 g may be given at induction of anaesthesia and repeated if necessary when the catheter is removed.

Ceftazidime can be used with an aminoglycoside, another beta lactam such as piperacillin, or vancomycin in patients with severe neutropenia, or, if infection with *Bacteroides fragilis* is suspected, with an antimicrobial such as clindamycin or metronidazole. The drugs should generally be given separately (see also Incompatibility, above).

#### References.

1. Rains CP, et al. Ceftazidime: an update of its antibacterial activity, pharmacokinetic properties and therapeutic efficacy. *Drugs* 1995; **49**: 577–617.

**Administration in renal impairment.** In patients with renal impairment the dosage of ceftazidime may need to be reduced. After a loading dose of 1 g, maintenance doses are based on the creatinine clearance (CC):

- CC 31 to 50 mL/minute: 1 g every 12 hours
- CC 16 to 30 mL/minute: 1 g every 24 hours
- CC 6 to 15 mL/minute: 500 mg every 24 hours
- CC less than 5 mL/minute: 500 mg every 48 hours

In severe infections these doses may need to be increased by 50%. In these patients ceftazidime trough serum concentrations should not exceed 40 micrograms/mL. In patients undergoing peritoneal dialysis a loading dose of 1 g may be given followed by 500 mg every 24 hours; ceftazidime sodium may also be added to the dialysis fluid, usually 125 to 250 mg of ceftazidime for 2 litres of dialysis fluid. In patients undergoing haemodialysis a loading dose of 1 g is given and then 0.5 to 1 g after each dialysis period.

#### Preparations

**USP 31:** Ceftazidime for Injection; Ceftazidime Injection.

**Proprietary Preparations** (details are given in Part 3)

**Arg.:** Crima; Fortum; Pluseptic; Tinacef; Zidima; **Austral.:** Fortum; **Austria:** Fortum; Kefazim; **Belg.:** Glazidim; Kefadim†; **Braz.:** Cefazima†; Cef-tanorth†; Ceftazidion; Cefthen; Cetaz; Fortaz; Intracef; Kefadim; Roycecefax†; **Canad.:** Ceptaz†; Fortaz; Tazidime†; **Chile:** Fortum; Kefzim†; **Cz.:** Fortum; Kefadim†; **Denm.:** Fortum; **Fin.:** Glazidim; **Fr.:** Fortum; Fortumset; **Ger.:** Fortum; InfectoZidim; **Gr.:** Cefin; Cefandem; Ftazidime; Lemoxol; Malocef; Novocral; Septax; Spiel; Solvetan; **Hong Kong:** Fortum; **Hung.:** Cetazime; Fortum; **India:** Cefazid; Cefaz; Cefcidin; Fortum; Zytaz; **Indon.:** Caltum; Cefum; Cetazum; Extimom; Fortum; Lacedim; Phorodime; Sodime; Thidim; Zefidim; Zibac; Zidifec; **Irl.:** Fortum; **Israel:** Fortum; **Ital.:** Cedizim; Cefum; Dizitec; Etazim; Fribat; Glazidim; Liotixil; Panzid; Spectrum; Starcef; Tazidif; Tottizim; **Malaysia:** Cef-4; Fortum; **Mex.:** Fenit; Fortum; Izadima; Lezidim†; Tagal; Taloken; Taxifur; Zadolina; Zidicef; **Neth.:** Fortum; Tazalux; **Norw.:** Fortum; **NZ:** Fortum; **Philipp.:** Baxidyne; Dimzef; Fortum; Forzid; Tazicef; Tazidan; Tazidem; Uniranaz; Zadim; Zeptrigen; **Pol.:** Biotum; Fortum; Mirocef; **Port.:** Cefortam; Cefazim; Zidimox; **Rus.:** Bestum (Бестум); Fortum (Фортум); Lorazidime (Лоразидим); **S.Afr.:** Fortum; Kefzim†; Taziject; **Singapore:** Cefazime; Fortum; **Spain:** Fortam; Kefamin; **Swed.:** Fortum; **Switz.:** Fortam; **Thai.:** CEF-4; Cef-Dime; Cefodime; Dimase; Fortadim; Fortum; Forzid; Fournox†; Zefam; **Turk.:** Fortum; Isetum; **UAE:** Negacef; **UK:** Fortum; Kefadim; **USA:** Ceptaz; Fortaz; Tazicef; Tazidime; **Venez.:** Betazidim; Biozidima; Cefgram; Fortum; Kesterina†.

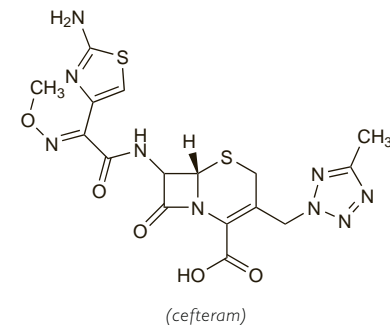
#### Cefteram Pivoxil (rINN)

Ceftéram, Pivoxil de; Cefteram pivoxilo; Cefterami Pivoxil; T-2588. Pivaloyloxymethyl (Z)-7-[2-(2-aminothiazol-4-yl)-2-methoxyiminoacetamido]-3-(5-methyl-2H-tetrazol-2-ylmethyl)-3-phenyl-4-carboxylic acid.

Цефтерама Пивоксил

$C_{22}H_{27}N_5O_7S_2 = 593.6$ .

CAS — 82547-58-8 (cefteram); 82547-81-7 (cefteram pivoxil).



#### Pharmacopoeias. In Jpn.

##### Profile

Cefteram is a cephalosporin antibacterial used for the treatment of susceptible infections. It is given orally as the pivaloyloxymethyl ester, cefteram pivoxil, and doses are expressed in terms of cefteram; 186 mg of cefteram pivoxil is equivalent to about 150 mg of cefteram. The usual dose is 150 to 300 mg daily in 3 divided doses after meals. For severe infections, up to 600 mg daily may be given.

For reference to carnitine deficiency occurring after the administration of some pivaloyloxymethyl esters, see Pivampicillin, p.317.

#### Preparations

**Proprietary Preparations** (details are given in Part 3)

**Jpn:** Tomiron.

#### Ceftezole Sodium (rINN)

Ceftezol sódico; Ceftezole Sodique; Natrii Ceftezolum. Sodium (7R)-7-[2-(1H-tetrazol-1-yl)acetamido]-3-(1,3,4-thiadiazol-2-ylthiomethyl)-3-cephem-4-carboxylate.

Натрий Цефтезол

$C_{13}H_{11}N_8NaO_4S_3 = 462.5$ .

CAS — 26973-24-0 (ceftezole); 41136-22-5 (ceftezole sodium).

ATC — J01DB12.

ATC Vet — QJ01DB12.

#### Pharmacopoeias. In Chin.

##### Profile

Ceftezole is a cephalosporin antibacterial with properties similar to those of cefalotin (p.219). It is given as the sodium salt but doses are expressed in terms of the base; 1.05 g of ceftezole sodium is equivalent to about 1 g of ceftezole. The usual dose is 2 to 4 g daily by intramuscular injection in 2 or 3 divided doses.

**Sodium content.** Each g of ceftezole sodium contains about 2.16 mmol of sodium.

#### Preparations

**Proprietary Preparations** (details are given in Part 3)

**Ital.:** Alomen.

#### Ceftibuten (BAN, USAN, rINN)

Ceftibuténe; Cefbuteno; Cefbutenum; Kefbuteneeni; 7432-5; Sch-39720. 7-[2-(2-Amino-1,3-thiazol-4-yl)-4-carboxyisocrotonamide]-3-cephem-4-carboxylic acid.

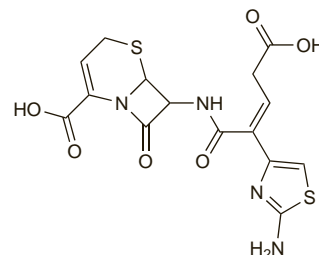
Цефтибутен

$C_{15}H_{14}N_4O_6S_2 = 410.4$ .

CAS — 97519-39-6.

ATC — J01DD14.

ATC Vet — QJ01DD14.



**Pharmacopoeias.** *Jpn* includes the dihydrate.