and glomerular filtration; about 60 to 70% of a dose appears within 8 hours as unchanged drug with only small quantities of metabolites. Only small amounts of unchanged drug and metabolites are excreted in the faeces.

Aztreonam is removed by haemodialysis and to a lesser extent by peritoneal dialysis.

◊ Reviews.

1. Mattie H. Clinical pharmacokinetics of aztreonam: an update. *Clin Pharmacokinet* 1994; **26:** 99–106.

Uses and Administration

Aztreonam is a monobactam or monocyclic beta-lactam antibacterial used parenterally as an alternative to aminoglycosides or third-generation cephalosporins for the treatment of infections caused by susceptible Gram-negative aerobic organisms. These have included bone and joint infections, gonorrhoea, intra-abdominal and pelvic infections, lower respiratory-tract infections including pseudomonal infections in patients with cystic fibrosis, meningitis, septicaemia, skin and soft-tissue infections, and urinary-tract infections. For details of these infections and their treatment, see under Choice of Antibacterial, p.162. To broaden the spectrum of activity for empirical treatment of infections, aztreonam should be used with other antibacterials. Use with an aminoglycoside may be of benefit in serious *Pseudomonas aeruginosa* infections.

Aztreonam is usually given parenterally by deep intramuscular injection, by slow intravenous injection over 3 to 5 minutes, or by intravenous infusion over 20 to 60 minutes. It is given to adults, in usual doses ranging from 1 to 8 g daily, in divided doses every 6 to 12 hours, according to the severity of the infection. Single doses over 1 g should be given by the intravenous route.

UK licensed product information recommends that infants older than one week and children be given aztreonam 30 mg/kg every 6 or 8 hours. For severe infections, children of 2 years or older may be given 50 mg/kg every 6 or 8 hours up to a maximum total daily dose of 8 g. Although not licensed in the UK for neonates less than one week old, the *BNFC* suggests a dose of 30 mg/kg every 12 hours. In the USA the dose for children from 9 months of age is 30 mg/kg every 8 hours for mild to moderate infection, or every 6 to 8 hours in moderate to severe infection up to a maximum total daily dose of 120 mg/kg.

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

A single intramuscular dose of 1 g has been recommended for the treatment of gonorrhoea or cystitis.

Aztreonam lysine is under investigation for inhalational use in respiratory-tract infections.

◊ General references.

1. Brogden RN, Heel RC. Aztreonam: a review of its antibacterial activity, pharmacokinetic properties and therapeutic use. *Drugs* 1986; **31:** 96–130.
2. Neu HC. ed. Aztreonam's role in the treatment of Gram-negative infections. *Am J Med* 1990; **88** (suppl 3C): 1S–43S.
3. Hellinger WC, Brewer NS. Carbapenems and monobactams: imipenem, meropenem, and aztreonam. *Mayo Clin Proc* 1999; **74:** 420–34.

Administration. References to the use of aztreonam (as aztreonam lysine) by inhalation in the treatment of airway infections in patients with cystic fibrosis.[1,2]

1. Gibson RL, *et al*. Microbiology, safety, and pharmacokinetics of aztreonam lysinate for inhalation in patients with cystic fibrosis. *Pediatr Pulmonol* 2006; **41:** 656–65.
2. Retsch-Bogart GZ, *et al*. A phase 2 study of aztreonam lysine for inhalation to treat patients with cystic fibrosis and Pseudomonas aeruginosa infection. *Pediatr Pulmonol* 2008; **43:** 47–58.

Administration in renal impairment. Dosage of aztreonam should be reduced in moderate to severe renal impairment. Patients with renal impairment may be given a usual initial dose followed by a maintenance dose adjusted according to creatinine clearance (CC):

- CC 10 to 30 mL/minute: half the initial dose
- CC less than 10 mL/minute: one-quarter of the initial dose
- haemodialysis patients: a supplementary dose of one-eighth of the initial dose may be given after each dialysis session

Preparations

USP 31: Aztreonam for Injection; Aztreonam Injection.

Proprietary Preparations (details are given in Part 3)

Arg.: Azactam†; ***Austral.:*** Azactam; ***Austria:*** Azactam; ***Belg.:*** Azactam; ***Braz.:*** Azactam; ***Chile:*** Azactam; ***Cz.:*** Azactam; ***Denm.:*** Azactam; ***Fin.:*** Azactam; ***Fr.:*** Azactam; ***Ger.:*** Azactam; ***Gr.:*** Azactam; Aztreotic†; ***Hong Kong:*** Azactam; ***India:*** Azenam; Trezam†; ***Irl.:*** Azactam; ***Israel:*** Azactam†; ***Ital.:*** Azactam; Primbactam; ***Jpn:*** Azactam; ***Mex.:*** Monobac; ***Norw.:*** Azactam; ***NZ:*** Azactam; ***Philipp.:*** Azactam; ***Pol.:*** Azactam; ***Port.:*** Azactam; ***S.Afr.:*** Azactam; ***Singapore:*** Azactam; ***Spain:*** Azactam; Urobactam†; ***Swed.:*** Azactam; ***Switz.:*** Azactam; ***UK:*** Azactam; ***USA:*** Azactam; ***Venez.:*** Azactam.

Bacampicillin Hydrochloride *(BANM, USAN, rINNM)*

Ampicillin Ethoxycarbonyloxyethyl Hydrochloride; Bacampicilline, chlorhydrate de; Bacampicillini hydrochloridum; Bakampicilin-hydrochlorid; Bakampicilino hidrochloridas; Bakampicillin-hidroklorid; Bakampicillinhydroklorid; Bakampisilin Hidroklorür; Bakampisilliinihydrokloridi; Carampicillin; EPC-272; Hidrocloruro de bacampicilina. 1-(Ethoxycarbonyloxy)ethyl (6*R*)-6-(α-D-phenylglycylamino)penicillanate hydrochloride.

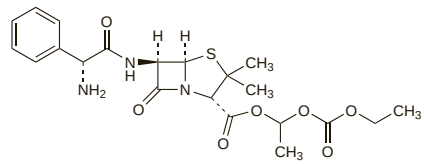
Бакампициллина Гидрохлорид

$C_{21}H_{27}N_3O_7S,HCl$ = 502.0.

CAS — 50972-17-3 (bacampicillin); 37661-08-8 (bacampicillin hydrochloride).

ATC — J01CA06.

ATC Vet — QJ01CA06.



(bacampicillin)

Pharmacopoeias. In *Eur.* (see p.vii), *Jpn*, and *US*.

Ph. Eur. 6.2 (Bacampicillin Hydrochloride). A white or almost white hygroscopic powder or granules. Soluble in water and in dichloromethane; freely soluble in alcohol. A 2% solution in water has a pH of 3.0 to 4.5. Store in airtight containers.

USP 31 (Bacampicillin Hydrochloride). A white or practically white, hygroscopic, powder. Soluble in water and in dichloromethane; freely soluble in alcohol and in chloroform; very slightly soluble in ether. pH of a 2% solution in water is between 3.0 and 4.5. Store in airtight containers.

Adverse Effects and Precautions

As for Ampicillin, p.204. Diarrhoea has been reported to occur less frequently with bacampicillin.

Interactions

As for Benzylpenicillin, p.214.

Antimicrobial Action

Bacampicillin has the antimicrobial action of ampicillin *in vivo* (p.204). It possesses no intrinsic activity and needs to be hydrolysed to ampicillin.

Pharmacokinetics

Bacampicillin is more rapidly and completely absorbed from the gastrointestinal tract than ampicillin, to which it is hydrolysed in the intestinal wall and plasma. Peak plasma-ampicillin concentrations occur about 30 to 60 minutes after oral doses, and are about 2 to 3 times those after an equivalent dose of ampicillin. The absorption of bacampicillin from tablets does not appear to be affected by the presence of food in the stomach. About 75% of a dose is excreted in the urine as ampicillin within 8 hours.

Uses and Administration

Bacampicillin has actions and uses similar to those of ampicillin (p.205) to which it is rapidly hydrolysed in the body. It is given orally as the hydrochloride in adult doses of 0.8 to 2.4 g daily, in 2 divided doses; children over 5 years of age have been given 25 to 50 mg/kg daily in 2 divided doses.

In uncomplicated gonorrhoea a single dose of bacampicillin hydrochloride 1.6 g with probenecid 1 g may be given in areas where gonococci remain sensitive.

Preparations

USP 31: Bacampicillin Hydrochloride for Oral Suspension; Bacampicillin Hydrochloride Tablets.

Proprietary Preparations (details are given in Part 3)

Austria: Penglobe; ***Belg.:*** Bacampicin†; ***Canad.:*** Penglobe†; ***Cz.:*** Penglobe†; ***Fr.:*** Bacampicine†; Penglobe†; ***Ger.:*** Ambacamp†; ***Hong Kong:*** Penglobe†; ***Hung.:*** Penglobe†; ***India:*** Penglobe; ***Ital.:*** Ampibac†; Bacacil; Bacagen; Bacasint; Bacattiv†; Bacillin; Bakam; Campixen†; Penglobe; Polibiotic†; Rebacil; Winnipeg; ***Malaysia:*** Penbaccin†; Penglobe†; ***Mex.:*** Penglobe†; ***Philipp.:*** Penglobe; ***Port.:*** Bacampicin†; ***Spain:*** Ambaxino†; Penglobe†; ***Swed.:*** Penglobe†; ***Thai.:*** Penglobe†; ***Turk.:*** Bakamsilin; Penbak.

Bacitracin *(BAN, rINN)*

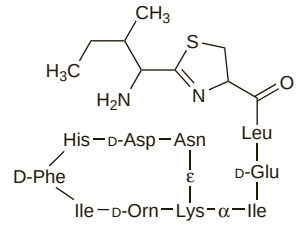
Bacitracina; Bacitracinas; Bacitracine; Bacitracinum; Bacytracyna; Basitrasiini; Basitrasin.

Бацитрацин

CAS — 1405-87-4.

ATC — D06AX05; R02AB04.

ATC Vet — QA07AA93; QD06AX05; QR02AB04.



(bacitracin A)

Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), *Int.*, *Jpn*, and *US*.

Ph. Eur. 6.2 (Bacitracin). Mixture of antimicrobial polypeptides produced by certain strains of *Bacillus licheniformis* or *B. subtilis*. The potency is not less than 60 units/mg, calculated with reference to the dried substance. A white or almost white hygroscopic powder. Freely soluble in water and in alcohol. A 1% solution in water has a pH of 6.0 to 7.0. Store at a temperature of 8° to 15° in airtight containers.

USP 31 (Bacitracin). A mixture of polypeptides produced by the growth of an organism of the *licheniformis* group of *Bacillus subtilis* (Bacillaceae). The main components are bacitracins A, B1, B2, and B3. It has a potency of not less than 65 units/mg, calculated with reference to the dried substance. It is a white to pale buff, hygroscopic powder, odourless or having a slight odour. Freely soluble in water; soluble in alcohol, in glacial acetic acid, and in methyl alcohol, the solution in the organic solvents usually showing some insoluble residue; insoluble in acetone, in chloroform, and in ether. Its solutions deteriorate rapidly at room temperature. It is precipitated from its solutions and is inactivated by salts of many of the heavy metals. pH of a solution in water containing 10 000 units/mL is between 5.5 and 7.5. Store in airtight containers at a temperature of 8° to 15°.

Bacitracin Zinc *(BANM, rINNM)*

Bacitracin zinečnatý komplex; Bacitracina zinc; Bacitracin-cink; Bacitracine Zincique; Bacitracine-zinc; Bacitracino cinko kompleksas; Bacitracins Zinc Complex; Bacitracinum Zincicum; Bacitracinum zincum; Bacytracyna cynkowa; Sinkkibasitrasiini; Zinc Bacitracin; Zinci Bacitracinum; Zinkbacitracin.

Цинка Бацитрацин

CAS — 1405-89-6.

ATC — D06AX05; R02AB04.

ATC Vet — QD06AX05; QR02AB04.

Pharmacopoeias. In *Eur.* (see p.vii), *Int.*, and *US*.

Ph. Eur. 6.2 (Bacitracin Zinc). The zinc complex of bacitracin. The potency is not less than 60 units/mg, calculated with reference to the dried substance. A white or light-yellowish-grey hygroscopic powder. Slightly soluble in water and in alcohol. The filtrate of a saturated solution has a pH of 6.0 to 7.5. Store in airtight containers.

USP 31 (Bacitracin Zinc). The zinc complex of bacitracin, which consists of a mixture of antimicrobial polypeptides, the main components being bacitracins A, B1, B2, and B3. It has a potency of not less than 65 units/mg, calculated with reference to the dried substance. It contains not less than 4% and not more than 6% of zinc, calculated with reference to the dried substance. A white or pale tan, hygroscopic powder, odourless or having a slight odour. Sparingly soluble in water. pH of a saturated solution in water is between 6.0 and 7.5. Store in airtight containers at a temperature of 8° to 15°.

Incompatibility. Bacitracin was slowly inactivated in bases containing stearyl alcohol, cholesterol, polyoxyethylene derivatives, and sodium laurilsulfate, and was rapidly inactivated in bases containing water, macrogols, propylene glycol, glycerol, cetylpyridinium chloride, benzalkonium chloride, ichthammol, phenol, and tannic acid.[1]

1. Plaxco JM, Husa WJ. The effect of various substances on the antibacterial activity of bacitracin in ointments. *J Am Pharm Assoc (Sci)* 1956; **45:** 141–5.

Stability. Bacitracin zinc was more stable than bacitracin and could be stored for 18 months at temperatures up to 40° without appreciable loss of activity. Lozenges of bacitracin zinc and ointments and tablets containing bacitracin zinc with neomycin were more stable than the corresponding bacitracin preparations. Bacitracin zinc was less bitter than bacitracin and the taste was more readily disguised.[1]

1. Gross HM, *et al*. Zinc bacitracin in pharmaceutical preparations. *Drug Cosmet Ind* 1954; **75:** 612–13.