

# Ampicyn

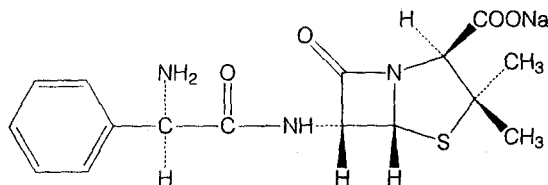
Ampicillin (as ampicillin sodium) Powder for Injection

1g AUST R 90881

## PRODUCT INFORMATION

### DESCRIPTION

Ampicyn (ampicillin sodium) has the chemical name of sodium (2*S*, 5*R*, 6*R*)-6-[(*R*)-2-amino-2-phenylacetamido]-3,3-dimethyl-7-oxo-4-thia-1-azabicyclo[3.2.0]heptane-2-carboxylate. Ampicillin sodium has the following structure:



$C_{16}H_{18}N_3NaO_4S$

Ampicillin sodium has a molecular weight of 371.4 and a CAS registry number, 69-52-3. Each vial contains 95.0 to 105.0% of the stated amount of ampicillin. Each one gram of monograph substance represents 2.7 mmol of sodium.

Ampicyn Powder for Injection is a fine white to off-white homogenous powder that is soluble in water. Ampicyn Powder for Injection contains no antiseptic or buffering agent nor are there any excipients.

### PHARMACOLOGY

#### Microbiology

Ampicillin is bactericidal and is active against a wider range of organisms than benzylpenicillin. It is less active than benzylpenicillin against Gram-positive organisms but is active *in vitro* against *Streptococcus pyogenes* (Group A,  $\beta$ -haemolytic Streptococci) and many strains of *Streptococcus pneumoniae* (*D. pneumonia*), *Streptococcus viridans*, non-penicillinase producing Staphylococci and *Enterococcus faecalis* (Group D Streptococci). There are strains of *Escherichia coli* that are sensitive to ampicillin, but isolates are becoming increasingly resistant *in vitro* due to the presence of penicillinase-producing strains. Some of the above organisms are sensitive to ampicillin only at concentrations achieved in the urine. Many strains of *Haemophilus influenzae*, *Neisseria meningitidis*, *Proteus mirabilis* and Salmonellae are sensitive to ampicillin, although the increasing incidence of beta-lactamase activity in *H. influenzae* and *E. coli* are reducing the capacity of ampicillin to treat diseases caused by these organisms.

Ampicillin is not effective against penicillinase producing bacteria, particularly resistant Staphylococci, which are now common. All strains of *Pseudomonas*, indole-positive *Proteus*, *Serratia marcescens*, *Enterobacter*, *Klebsiella*, *Citrobacter* and penicillinase producing *Neisseria gonorrhoeae* are resistant.

Like benzylpenicillin, ampicillin is bactericidal to sensitive organisms during the stage of active cell division. It is believed to act through the inhibition of cell wall synthesis.

#### Susceptibility tests

Dilution or diffusion techniques – either quantitative (MIC) or breakpoint, should be used following a regularly updated, recognised and standardised method (eg. NCCLS). Standardised susceptibility test procedures require the use of laboratory control microorganisms to control the technique aspects of the laboratory procedures. A report of “Susceptible” indicates that the pathogen is likely to be inhibited if the antimicrobial compound in the blood reaches the concentrations achievable. A report of “Intermediate” indicates that the result should be considered equivocal, and if the microorganism is not fully susceptible to alternative, clinically feasible drugs, the test should be repeated. This category implies possible clinical applicability in body sites where the drug is physiologically concentrated or in situations where high dosage of drug can be used. This category also provides a buffer zone, which prevents small-uncontrolled technical factors from causing major discrepancies in interpretation. A report of “Resistant” indicates that the pathogen is not likely to be inhibited if the antimicrobial compound in the blood reaches the concentrations usually achievable; other therapy should be selected.

Note: The prevalence of resistance may vary geographically for selected species and local information on resistance is desirable, particularly when treating severe infections.

#### Pharmacokinetics

Ampicillin sodium diffuses readily into most body tissues and fluids with the exception of brain and spinal fluid. Intramuscular injections of 500mg and 1g of ampicillin sodium result in peak plasma concentrations of around 7 and 10mg/L respectively at one hour. Intravenous injection of 500mg of ampicillin sodium yields a peak plasma

concentration of 17mg/L at 15 minutes. Some penetration occurs through inflamed meninges but maximum CSF levels are very much lower than peak serum levels. Ampicillin is excreted mainly via the urine where it exists at 0 to 6 hours at a concentration of 0.9 to 2.2g/L following a 500mg intramuscular dose and 0.1 to 0.6g/L after 500mg given intravenously.

The amount to be found in bile is variable. Approximately 0.1% is excreted unchanged in the bile.

The half-life of ampicillin is approximately 1 hour with normal renal function and up to 20 hours in the total absence of renal function. Renal clearance of ampicillin is slower than that of benzylpenicillin.

Ampicillin is excreted in the urine both unchanged and as penicilloic acid. About 66% of a 500mg intramuscular dose and 73% of a 500mg intravenous dose is excreted in the urine in 6 hours in the presence of normal renal function. Ampicillin is not highly protein-bound;  $29 \pm 12\%$  is reported to be protein-bound in the serum.

Excretion of ampicillin can be delayed by concurrent administration of probenecid, thus prolonging its therapeutic effect.

## **INDICATIONS**

Treatment of infections due to susceptible strains of Gram-positive and Gram-negative organisms (see **Microbiology**). Bacteriological studies to determine the organism and its sensitivity should be undertaken.

## **CONTRAINDICATIONS**

Ampicillin is a penicillin and should not be given to patients with a history of a hypersensitivity to beta-lactam antibiotics (eg. penicillins, cephalosporins).

## **PRECAUTIONS**

Serious, and occasionally fatal, hypersensitivity reactions (anaphylaxis) have been reported in patients receiving beta-lactam antibiotics. Although anaphylaxis is more frequent following parenteral therapy, it has occurred in patients on oral therapy. Before commencing therapy with any beta-lactam antibiotic, careful enquires should be made concerning previous hypersensitivity reactions to penicillins, cephalosporins or other allergens. If a hypersensitivity reaction occurs, appropriate therapy should be instituted and Ampicyn therapy discontinued.

Serious anaphylactoid reactions require immediate emergency treatment with adrenaline. Oxygen, intravenous steroids and airway management including intubation, should also be administered as indicated.

Antibiotic associated pseudomembranous colitis has been reported with many antibiotics including ampicillin. A toxin produced by *Clostridium difficile* appears to be the primary cause. The severity of the colitis may range from mild to life threatening. It is important to consider this diagnosis in patients who develop diarrhoea or colitis in association with antibiotic use (this may occur up to several weeks after cessation of antibiotic therapy). Mild cases usually respond to drug discontinuation alone. However in moderate to severe cases, appropriate therapy with a suitable oral antibacterial agent effective against *Clostridium difficile* should be considered. Fluids, electrolyte and protein replacement should be provided when indicated. Drugs which delay peristalsis, eg. opiates and diphenoxylate with atropine (Lomotil) may prolong and/or worsen the condition and should not be used.

Caution should be exercised in the treatment of patients with an allergic diathesis.

Ampicyn is not the treatment of choice in patients presenting with sore throat or pharyngitis. This is because the underlying cause may be infectious mononucleosis, in the presence of which there is a high incidence of rash if ampicillin is used. Patients with lymphatic leukaemia also appear to have a higher incidence of skin rashes when treated with ampicillin.

As with any potent drug, periodic assessment of renal, hepatic and haematopoietic function should be made during prolonged therapy. The possibility of superinfections with mycotic or bacterial pathogens should be kept in mind during therapy. If superinfections occur (usually involving *Enterobacter*, *Pseudomonas* or *Candida*), the drug should be discontinued and/or appropriate therapy instituted.

Indwelling urethral catheters should be checked regularly as the high concentrations of ampicillin in the urine may cause it to precipitate out of solution at room temperature. The risk of crystalluria should be avoided by maintaining a high urinary output.

## **Use in Pregnancy (Category A)**

Ampicillin diffuses across the placenta into the foetal circulation. Animal studies with ampicillin have shown no

teratogenic effects. The product has been in clinical use for nearly 30 years and the limited number of reported cases of use in human pregnancy have shown no evidence of untoward effect. The use of Ampicyn in pregnancy should be reserved for cases considered essential by the clinician.

### **Use in Labour and Delivery**

Studies in guinea pigs have shown that intravenous administration of ampicillin decreases uterine tone and the frequency, strength and duration of contractions. However it is not known whether the use of ampicillin in humans during labour or delivery has any immediate or delayed adverse effects, prolongs the duration of the labour or increases the likelihood that forceps delivery or other obstetrical intervention or resuscitation of the newborn will be necessary.

### **Use in Lactation**

Ampicillin is excreted in breast milk. An alternative feeding method is recommended to avoid any possible sensitisation of the newborn.

### **Interactions with Other Drugs**

Probenecid decreases the renal tubular secretion of ampicillin. Concurrent use with Ampicyn may result in increased and prolonged blood levels of ampicillin.

Tetracyclines, erythromycin and chloramphenicol antagonise the action of ampicillin.

Gentamicin should not be mixed with ampicillin when both drugs are given parenterally as inactivation occurs.

The concurrent administration of allopurinol and ampicillin increases substantially the incidence of rashes in patients receiving both drugs as compared to patients receiving ampicillin alone. It is not known whether this potentiation of ampicillin rashes is due to allopurinol or the hyperuricaemia present in these patients.

In common with other antibiotics, patients should be warned that Ampicyn may reduce the effectiveness of oral contraceptives.

### **Effects in Laboratory Tests**

As administration of Ampicyn will result in high ampicillin concentrations in the urine, false positive reactions may be elicited when testing the urine for glucose with Clinitest, Benedict's solution or Fehling's solution. Tests based on enzymatic glucose oxidase reactions such as Testape or Clinistix should be used instead.

Following administration of ampicillin to pregnant women, a transient decrease in plasma concentration of total conjugated estriol, estriol-glucuronide, conjugated estrone and estradiol has been noted.

## **ADVERSE REACTIONS**

As with all penicillins, the possibility of allergic reactions should always be considered. Reactions are more likely to occur in those with an allergic diathesis. Anaphylactic shock is most likely to occur with injected penicillins (see **PRECAUTIONS**).

The following adverse reactions have been reported as associated with the use of ampicillin:

**GASTRO-INTESTINAL:** Glossitis, stomatitis, black hairy tongue, nausea, vomiting and diarrhoea. These reactions are usually associated with oral dosage forms (see **PRECAUTIONS**).

**HYPERSENSITIVITY REACTIONS:** An erythematous maculopapular rash has been reported fairly frequently. A macular rash, which is not believed to be a hypersensitivity reaction, occurs predominantly in patients with infectious mononucleosis 4 to 5 days after beginning therapy with ampicillin.

Urticaria and erythema multiforme have been reported occasionally. A few cases of exfoliative dermatitis have been reported. Anaphylaxis is the most serious reaction experienced (see **PRECAUTIONS**).

**NOTE:** Urticaria, other skin rashes, and serum sickness-like reactions may be controlled with antihistamines and, if necessary, systemic corticosteroids. Whenever such reactions occur, ampicillin should be discontinued unless, in the opinion of the physician, the condition being treated is life-threatening and amenable only to ampicillin therapy.

**HEPATIC:** A moderate rise in aspartate aminotransferase (AST) has been noted, particularly in infants, but the significance of this finding is unknown. As with other beta-lactam antibiotics, hepatitis and cholestatic jaundice have been reported rarely.

**HAEMATOLOGICAL:** Anaemia, thrombocytopenia, haemolytic anaemia, thrombocytopenic purpura, eosinophilia, leucopenia and agranulocytosis have been reported during therapy with the penicillins. These reactions are usually reversible on discontinuation of therapy, and are believed to be sensitivity reactions.

RENAL: Nephropathy has been reported rarely.

CNS: Encephalopathy can occur when the ampicillin blood level reaches 800mg/L. As the blood brain barrier becomes more permeable in meningitis, toxic symptoms may be precipitated by lower levels of ampicillin in patients with meningitis. This can result in drowsiness, hyper-reflexia, myoclonic twitches, convulsions and coma.

INJECTION SITE: Pain may be experienced at the site of intramuscular injection and phlebitis at the site of intravenous injection.

OTHER: Vaginal or oral moniliasis may occur following the use of antibiotics.

Seventy two percent of all adverse events to ampicillin recorded in the Australian Adverse Drug Reaction System include rash as a symptom.

## **DOSAGE AND ADMINISTRATION**

Ampicyn may be given by intramuscular injection, by intravenous infusion or by SLOW intravenous injection.

### **Respiratory Tract Infections**

Adults: 250 to 500mg six hourly.

Children: 25 to 50mg/kg/day in equally divided doses, six hourly.

### **Chronic Bronchitis**

Adults: 500mg six hourly. (High dosage therapy - 1g six hourly).

### **Urinary Tract Infections**

Adults: 500mg six hourly.

Children: 50mg/kg/day in equally divided doses, six hourly.

### **Gastrointestinal Tract Infections**

Adults: 500 to 750mg six hourly.

Children: 50 to 70mg/kg/day in equally divided doses, six hourly.

The children's dosage is intended for individuals whose weight will not cause a dosage to be calculated greater than that recommended for adults. Children weighing more than 20kg should be dosed according to the adult recommendations. It should be recognised that frequent bacteriological and clinical appraisals are necessary in the treatment of chronic urinary tract and intestinal infections.

Smaller doses than those recommended above should not be used. Higher doses may be needed at times. The usual duration of therapy is 5 to 10 days but in some cases therapy may be required for longer durations. Treatment should be continued for a minimum of 48 to 72 hours beyond the time that the patient becomes asymptomatic or evidence of bacterial eradication has been obtained. It is recommended that there be at least 10 days treatment for any infection caused by haemolytic Streptococci to help prevent the occurrence of acute rheumatic fever or glomerulonephritis.

### **Bacterial Meningitis and Septicaemia**

Adults and children: 200mg/kg/day in equally divided doses, four to six hourly, intravenously, with an upper limit of 12g daily.

### **Intraperitoneal Use**

At least 500mg per 10mL Water for Injections daily.

### **Intrapleural Use**

500mg in 5 to 10mL Water for Injections daily.

### **Intra-articular**

500mg daily, dissolved in up to 5mL of Water for Injections, or 0.5% procaine hydrochloride.

### **Intrathecal Use**

Not recommended.

### **Neonatal Dosage**

The half-life of ampicillin sodium varies inversely with age in neonates. The recommended dosage is 25mg/kg (50mg/kg for meningitis) at the following intervals:

Infants < 2000g and 0 to 7 days: every 12 hr

Infants < 2000g and > 7 days: every 8 hr

Infants > 2000g and 0 to 7 days: every 8 hr

Infants > 2000g and > 7 days: every 6 hr

### Impaired Renal Function

In renal impairment the excretion of the antibiotic will be delayed and depending on the degree of impairment, it may be necessary to reduce the total daily dosage. The following dosage schedule is recommended.

Glomerular Filtration Rate (mL/min)	Dose	Dosage Interval (Hours)
10 to 50	Normal	6 to 12
<10	Normal	12 to 16

### PREPARATION OF INJECTIONS

Ampicillin sodium is unstable in concentrated solutions and contains no anti-microbial preservative. When Ampicyn is reconstituted with Water for Injections, it must be administered immediately to reduce microbiological hazard. Shake the vial immediately after adding the diluent.

Following reconstitution, Ampicyn may be held in certain intravenous fluids as described in Table 2 (see **STABILITY AND STORAGE**). Each Ampicyn vial should be used in one patient on one occasion only and any residue discarded.

### Intramuscular Administration

- (a) When the entire contents of a vial are to be used, 1.5mL of Water for Injections should be added to the 1g vial.
- (b) When only part of a vial's contents is required, the amount of Water for Injections which should be added to provide a convenient final concentration is shown in **Table 1**. The remaining contents of the vial should be discarded.

**Table 1**

Label Strength	Final Concentration (mg/mL)	Recommended amount of sterile Water for Injections
1g	500mg/mL	1.3mL
	250mg/mL	3.3mL
	100mg/mL	9.3mL

### Direct Intravenous Administration

Reconstitute in 10 to 20mL of Water for Injections and inject **SLOWLY** over 3 to 5 minutes.

**Caution - more rapid administration may result in convulsive seizures.**

### Intravenous Infusion

Reconstitute as for intramuscular administration prior to diluting with intravenous solution. The ampicillin solution should be administered as a rapid infusion over 30 to 40 minutes.

### OVERDOSAGE

Encephalopathy can occur when the ampicillin blood level reaches 800mg/L. As the blood brain barrier becomes more permeable in meningitis, toxic symptoms may be precipitated by lower levels of ampicillin in patients with meningitis. This can result in drowsiness, hyper-reflexia, myoclonic twitches, convulsions and coma.

There is no specific treatment for Ampicyn overdosage. Ampicillin is removed by haemodialysis. Patients usually recover as the penicillin blood level decreases.

### STABILITY AND STORAGE

Ampicyn should be stored below 25°C, protected from light.

Dry powder:	If stored below 25°C, potency is maintained until the expiry date on the container label.
Solution:	Ampicillin is unstable in concentrated solution and when prepared for injection or infusion, should be administered immediately.
Intravenous Fluids:	To reduce microbiological hazard, use as soon as practicable after reconstitution/dilution. If required, Ampicyn may be held at 2-8°C in certain intravenous fluids following reconstitution.

**Table 2: Storage of Intravenous Fluids at 2 - 8°C**

INTRAVENOUS FLUID	CONCENTRATION TESTED	POTENCY LOSS		
		1 HOUR	6 HOURS	24 HOURS
Physiological Saline*	15g/500mL	Not Tested	<5%	10%
M/6 Sodium Lactate <sup>+</sup>	15g/500mL	Not Tested	10%	-
Ringer's Solution*	4g/500mL	Not Tested	<5%	<10%
1.4% Sodium Bicarbonate <sup>+</sup>	4g/500mL	Not Tested	10%	Not Tested
Rheomacrodex 10% in Physiological in Saline <sup>+</sup>	4g/500mL	Not Tested	10%	25%

+ Reconstituted Ampicyn Powder for Injection (as ampicillin sodium) should be used within 6 hours in M/6 Sodium Lactate, 1.4% sodium bicarbonate and 10% Rheomacrodex in physiological saline (Dextran 40 Injection BP in Sodium Chloride Injection) (**see PREPARATION OF INJECTIONS – Direct Intravenous Administration**).

\* It is stable in normal saline and Ringer's solution (Compound Sodium Chloride Injection BP 1959) for up to 24 hours.

Reconstituted Ampicyn Powder for Injection should not be added to infusion bottles containing 10% Rheomacrodex in 5% glucose (Dextran 40 Injection BP in Glucose Injection), 5% glucose or glucose saline, but may be injected into the drip tubing of such an infusion (**see PREPARATION OF INJECTIONS – Direct Intravenous Administration**).

## **PRESENTATION**

Ampicyn Powder for Injection is available in vials containing 1g of ampicillin (as ampicillin sodium) in boxes of 5 vials.

## **SPONSOR**

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