

CAVUMOX SYRUP

NAME AND STRENGTH OF ACTIVE SUBSTANCE

Each 5 mL (when reconstituted) contains 125 mg amoxicillin (as amoxicillin trihydrate) and 31.25 mg clavulanic acid (as potassium clavulanate).

PRODUCT DESCRIPTION

Creamy white powder with characteristic odour.

After reconstitution, it yields a creamy white suspension.

PHARMACODYNAMICS

Pharmacotherapeutic group: antibacterials for systemic use; beta-lactamase antibacterials, penicillins; combination of penicillins, including beta-lactamase inhibitors.

ATC code: J01CR02

Mechanism of action

Amoxicillin is a semisynthetic penicillin (beta-lactam antibiotic) that inhibits one or more enzymes (often referred to as penicillin-binding proteins, PBPs) in the biosynthetic pathway of bacterial peptidoglycan, which is an integral structural component of the bacterial cell wall. Inhibition of peptidoglycan synthesis leads to weakening of the cell wall, which is usually followed by cell lysis and death.

Amoxicillin is susceptible to degradation by beta-lactamases produced by resistant bacteria and therefore the spectrum of activity of amoxicillin alone does not include organisms which produce these enzymes.

Clavulanic acid is a beta-lactam structurally related to penicillins. It inactivates some beta-lactamase enzymes thereby preventing inactivation of amoxicillin. Clavulanic acid alone does not exert a clinically useful antibacterial effect.

Pharmacokinetic/pharmacodynamic relationship

The time above the minimum inhibitory concentration ($T > MIC$) is considered to be the major determinant of efficacy for amoxicillin.

Mechanisms of resistance

The two main mechanisms of resistance to amoxicillin/clavulanic acid are:

- Inactivation by those bacterial beta-lactamases that are not themselves inhibited by clavulanic acid, including class B, C and D.
- Alteration of PBPs, which reduce the affinity of the antibacterial agent for the target.

Impermeability of bacteria or efflux pump mechanisms may cause or contribute to bacterial resistance, particularly in Gram-negative bacteria.

Breakpoints

MIC breakpoints for amoxicillin/clavulanic acid are those of the European Committee on Antimicrobial Susceptibility Testing (EUCAST)

Organism	Susceptibility Breakpoints ($\mu\text{g/ml}$)		
	Susceptible	Intermediate	Resistant
<i>Haemophilus influenzae</i> ¹	≤ 1	-	> 2
<i>Moraxella catarrhalis</i> ¹	≤ 1	-	> 1
<i>Staphylococcus aureus</i> ²	≤ 2	-	> 2
Coagulase-negative staphylococci ²	≤ 0.25		> 0.25

<i>Enterococcus</i> ¹	≤ 4	8	> 8
<i>Streptococcus</i> groups A, B, C, G ⁵	≤ 0.25	-	> 0.25
<i>Streptococcus pneumoniae</i> ³	≤ 0.5	1 – 2	> 2
Enterobacteriaceae ^{1,4}	-	-	> 8
Gram-negative Anaerobes ¹	≤ 4	8	> 8
Gram-positive Anaerobes ¹	≤ 4	8	> 8
Non-species related breakpoints ¹	≤ 2	4 – 8	> 8

¹The reported values are for amoxicillin concentrations. For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/l.

²The reported values are Oxacillin concentrations.

³Breakpoint values in the table are based on Ampicillin breakpoints.

⁴The resistant breakpoint of R>8 mg/l ensures that all isolates with resistance mechanisms are reported resistant.

⁵Breakpoint values in the table are based on benzylpenicillin breakpoints.

The prevalence of resistance may vary geographically and with time for selected species, and local information on resistance is desirable, particularly when treating severe infections. As necessary, expert advice should be sought when the local prevalence of resistance is such that the utility of the agent in at least some types of infections is questionable.

Commonly susceptible species

Aerobic Gram-positive micro-organisms

Enterococcus faecalis

Gardnerella vaginalis

Staphylococcus aureus (methicillin-susceptible)^f

Coagulase-negative staphylococci (methicillin-susceptible)

Streptococcus agalactiae

*Streptococcus pneumoniae*¹

Streptococcus pyogenes and other beta-haemolytic streptococci

Streptococcus viridans group

Aerobic Gram-negative micro-organisms

Capnocytophaga spp.

Eikenella corrodens

*Haemophilus influenzae*²

Moraxella catarrhalis

Pasteurella multocida

Aerobic micro-organisms

Bacteroides fragilis

Fusobacterium nucleatum

Prevotella spp.

<u>Species for which acquired resistance may be a problem</u>
<u>Aerobic Gram-positive micro-organisms</u> <i>Enterococcus faecium</i> [§]
<u>Aerobic Gram-negative micro-organisms</u> <i>Escherichia coli</i> <i>Klebsiella oxytoca</i> <i>Klebsiella pneumoniae</i> <i>Proteus mirabilis</i> <i>Proteus vulgaris</i>
<u>Inherently resistant organisms</u>
<u>Aerobic Gram-negative micro-organisms</u> <i>Acinetobacter</i> sp. <i>Citrobacter freundii</i> <i>Enterobacter</i> sp. <i>Legionella pneumophila</i> <i>Morganella morganii</i> <i>Providencia</i> spp. <i>Pseudomonas</i> sp. <i>Serratia</i> sp. <i>Stenotrophomonas maltophilia</i>
<u>Other micro-organisms</u> <i>Chlamydophila pneumoniae</i> <i>Chlamydophila psittaci</i> <i>Coxiella burnetii</i> <i>Mycoplasma pneumoniae</i>
[§] Natural intermediate susceptibility in the absence of acquired mechanism of resistance. [£] All methicillin-resistant staphylococci are resistant to amoxicillin/clavulanic acid. ¹ <i>Streptococcus pneumoniae</i> that are resistant to penicillin should not be treated with this presentation of amoxicillin/clavulanic acid. ² Strains with decreased susceptibility have been reported in some countries in the EU with a frequency higher than 10%.

PHARMACOKINETICS

Absorption

Amoxicillin and clavulanic acid are fully dissociated in aqueous solution at physiological pH. Both components are rapidly and well absorbed by the oral route of administration. Following oral administration, amoxicillin and clavulanic acid are approximately 70% bioavailable. The plasma profiles of both components are similar and the time to peak plasma concentrations (T_{max}) in each case is approximately one hour.

The pharmacokinetic results for a study, in which amoxicillin/clavulanic acid (500 mg/125 mg tablets three times daily) was administered in the fasting state to groups of healthy volunteers are presented below.

Mean (\pm SD) pharmacokinetic parameters					
Active substance(s) administered	Dose (mg)	C _{max} (μ g/ml)	T _{max} * (h)	AUC _(0-24h) (μ g.h/mL)	T _{1/2} (h)
Amoxicillin					
AMX/CA 500/125 mg	500	7.19 \pm 2.26	1.5 (1.0 – 2.5)	53.5 \pm 8.87	1.15 \pm 0.20
Clavulanic acid					
AMX/CA 500 mg / 125 mg	125	2.40 \pm 0.83	1.5 (1.0 – 2.0)	15.72 \pm 3.86	0.98 \pm 0.12
AMX – amoxicillin, CA – clavulanic acid					
*Median (range)					

Amoxicillin and clavulanic acid serum concentrations achieved with amoxicillin/clavulanic acid are similar to those produced by the oral administration of equivalent doses of amoxicillin or clavulanic acid alone.

Distribution

About 25% of total plasma clavulanic acid and 18% of total plasma amoxicillin is bound to protein. The apparent volume of distribution is around 0.3 – 0.4 L/kg for amoxicillin and around 0.2 L/kg for clavulanic acid.

Following intravenous administration, both amoxicillin and clavulanic acid have been found in gall bladder, abdominal tissue, skin, fat, muscle tissues, synovial and peritoneal fluids, bile and pus. Amoxicillin does not adequately distribute into the cerebrospinal fluid.

From animal studies there is no evidence for significant tissue retention of drug-derived material for either component. Amoxicillin, like more penicillins, can be detected in breast milk. Trace quantities of clavulanic acid can also be detected in breast milk.

Both amoxicillin and clavulanic acid have been shown to cross the placental barrier.

Biotransformation

Amoxicillin is partly excreted in the urine as the inactive penicilloic acid in quantities equivalent to up to 10–25% of the initial dose. Clavulanic acid is extensively metabolized in man and eliminated in urine and faeces and as carbon dioxide in expired air.

Elimination

The major route of elimination for amoxicillin is via the kidney, whereas for clavulanic acid it is by both renal and non-renal mechanisms.

Amoxicillin/clavulanic acid has a mean elimination half-life of approximately one hour and a mean total clearance of approximately 25 L/h in healthy subjects. Approximately 60 to 70% of the amoxicillin and approximately 40 to 65% of the clavulanic acid are excreted unchanged in urine during the first 6 h after administration of single amoxicillin/clavulanic acid 250 mg / 125 mg or 500 mg / 125 mg tablets. Various studies have found the urinary excretion to be 50 – 85% for amoxicillin and between 27 – 60% for clavulanic acid over a 24-hour period. In the case of clavulanic acid, the largest amount of drug is excreted during the first 2 hours after administration.

Concomitant use of probenecid delays amoxicillin excretion but does not delay renal excretion of clavulanic acid.

Age

The elimination half-life of amoxicillin is similar to children aged around 3 months to 2 years and older children and adults. For very young children (including preterm newborns) in the first week of life the interval of administration should not exceed twice daily administration due to immaturity of the renal pathway of elimination. Because elderly patients are more likely to have decreased renal function, care should be taken in dose selection, and it may be useful to monitor renal function.

Gender

Following oral administration of amoxicillin/clavulanic acid to healthy males and female subjects, gender has no significant impact on the pharmacokinetics of either amoxicillin or clavulanic acid.

Renal impairment

The total serum clearance of amoxicillin/clavulanic acid decreases proportionately with decreasing renal function. The reduction in drug clearance is more pronounced in amoxicillin than for clavulanic acid, as a higher proportion of amoxicillin is excreted *via* the renal route. Doses in renal impairment must therefore prevent undue accumulation of amoxicillin while maintaining adequate levels of clavulanic acid.

Hepatic impairment

Hepatically impaired patients should be dosed with caution and hepatic function monitored at regular intervals.

INDICATION

For the treatment of common bacterial infections where oral therapy is indicated, including:

- Upper respiratory tract infections (including ENT): sinusitis, tonsillitis, otitis media.
- Skin and soft tissue infections: boils/abscesses, cellulitis, wound infections, intra-abdominal sepsis
- Lower respiratory tract infections: acute and chronic bronchitis, pneumonia, lung abscess
- Genito-urinary tract infections: cystitis, urethritis, pyelonephritis, septic abortion, pelvic infection
- Other infections: osteomyelitis, peritonitis, postoperative infections.

Consideration should be given to official guidance on the appropriate use of antibacterial agents.

DOSAGE AND ADMINISTRATION

Posology

CAVUMOX oral dosage recommendations for children below the age of 12 years are based on 25 – 50 mg/kg body weight/day (based on amoxicillin component) depending on the severity of infection,

Children 7 – 12 years: 10 mL CAVUMOX three times a day*

Children 2 – 7 years: 5 mL CAVUMOX three times a day*

Children 9 months – 2 years: 2.5 mL CAVUMOX three times a day

Children 0 – 9 months: No suitable oral presentation is currently available for this age group

Treatment with CAVUMOX should not be extended beyond 14 days without review.

*These doses may be doubled in severe infections.

Elderly

No dose adjustment is considered necessary.

The duration of therapy should be determined by the response of the patient. Some infections (e.g., osteomyelitis) require longer period of treatment. Treatment should not be extended beyond 14 days without review.

Renal Impairment

No adjustment in dose is required in patients with creatinine clearance (CrCl) greater than 30 mL/min.

Hepatic Impairment

Dose with caution and monitor hepatic function at regular intervals.

Method of administration

CAVUMOX is for oral use.

CAVUMOX should be administered with a meal to minimize potential gastrointestinal intolerance.

Therapy should be started parenterally according to the SmPC of the IV-formulation and continued with an oral preparation.

Direction for use

- Invert and shake bottle to loosen powder.
- Remove the cap, fill the bottle with water to just below the mark on the bottle label.
- Invert and shake well, then top up with water to the mark. Invert and shake again.
- Shake well before taking each dose.

CONTRAINDICATIONS

Hypersensitivity to the active substances, to any of the penicillins or to any of the excipients.

History of a severe immediate hypersensitivity reaction (e.g., anaphylaxis) to another beta-lactam agent (e.g., a cephalosporin, carbapenem or monobactam).

History of jaundice/hepatic impairment due to amoxicillin/clavulanic acid.

WARNINGS AND PRECAUTIONS

Before initiating therapy with amoxicillin/clavulanic acid, careful enquiry should be made concerning previous hypersensitivity reactions to penicillins, cephalosporins, or other beta-lactam agents.

Serious and occasionally fatal hypersensitivity reactions (including anaphylactoid and severe cutaneous adverse reactions) have been reported in patients on penicillin therapy. These reactions are more likely to occur in individuals with a history of penicillin hypersensitivity and in atopic individuals. If an allergic reaction occurs, amoxicillin/clavulanic acid therapy must be discontinued and appropriate alternative therapy instituted.

In the case that an infection is proven to be due to an amoxicillin-susceptible organism(s) then consideration should be given to switching from amoxicillin/clavulanic acid to amoxicillin in accordance with official guidance.

This presentation of CAVUMOX is not suitable for use when there is a high risk that the resumptive pathogens have reduced susceptibility or resistance to beta-lactam agents that is not mediated by beta-lactamases susceptible to inhibition by clavulanic acid. This presentation should not be used to treat penicillin-resistant *S. pneumoniae*.

Convulsions may occur in patients with impaired renal function or in those receiving high doses.

Amoxicillin/clavulanic acid should be avoided if infectious mononucleosis is suspected since the occurrence of a morbilliform rash has been associated with this condition following the use of amoxicillin.

Concomitant use of allopurinol during treatment with amoxicillin can increase the likelihood of allergic skin reactions.

Prolonged use may occasionally result in overgrowth of non-susceptible organisms.

The occurrence at the treatment initiation of a feverish generalized erythema associated with pustula may be a symptom of acute generalized exanthematous pustulosis (AGEP). This reaction requires CAVUMOX discontinuation and contraindicates any subsequent administration of amoxicillin.

Amoxicillin/clavulanic acid should be used with caution in patients with evidence of hepatic impairment.

Hepatic events have been reported predominantly in males and elderly patients and may be associated with prolonged treatment. These events have been very rarely reported in children. In all populations, signs and symptoms usually occur during or shortly after treatment but in some cases may not become apparent until several weeks after treatment has ceased. These are usually reversible. Hepatic events may be severe and, in extremely rare circumstances, deaths have been reported. These have almost always occurred in patients with serious underlying disease or taking concomitant medications known to have the potential for hepatic effects.

Antibiotic-associated colitis has been reported with nearly all antibacterial agents including amoxicillin and may range in severity from mild to life threatening. Therefore, it is important to consider this diagnosis in patients who present with diarrhoea during or subsequent to the administration of any antibiotics. Should antibiotic-associated colitis occur, amoxicillin/clavulanic acid should immediately be discontinued, a physician be consulted and an appropriate therapy initiated. Anti-peristaltic medicinal products are contraindicated in this situation.

Periodic assessment of organ system functions, including renal, hepatic and haematopoietic function is advisable during prolonged therapy.

Prolongation of prothrombin time has been reported rarely in patients receiving amoxicillin/clavulanic acid. Appropriate monitoring should be undertaken when anticoagulants are prescribed concomitantly. Adjustments in the dose of oral anticoagulants may be necessary to maintain the desired level of anticoagulation.

In patients with renal impairment, the dose should be adjusted according to the degree of impairment.

In patients with reduced urine output, crystalluria has been observed very rarely, predominantly with parenteral therapy. During the administration of high doses of amoxicillin, it is advisable to maintain adequate fluid intake and urinary output in order to reduce the possibility of amoxicillin crystalluria. In patients with bladder catheters, a regular check of patency should be maintained.

During treatment with amoxicillin, enzymatic glucose oxidase methods should be used whenever testing for the presence of glucose in urine because false positive results may occur with non-enzymatic methods.

The presence of clavulanic acid in Augmentin may cause a non-specific binding of IgG and albumin by red cell membranes leading to a false positive Coombs test.

There have been reports of positive test results using the Bio-Rad Laboratories Platelia *Aspergillus* EIA test in patients receiving amoxicillin/clavulanic acid who were subsequently found to be free of *Aspergillus* infection. Cross-reactions with non-*Aspergillus* polysaccharides and polyfuranoses with Bio-Rad Laboratories Platelia *Aspergillus* EIA test have been reported. Therefore, positive test results in patients receiving amoxicillin/clavulanic acid should be interpreted cautiously and confirmed by other diagnostic methods.

Serious and occasionally fatal hypersensitivity (including anaphylactoid and severe cutaneous adverse reactions) have been reported in patients receiving therapy with beta-lactams. Before initiating therapy with CAVUMOX, careful inquiry should be made concerning previous hypersensitivity reactions to penicillin, cephalosporins, carbapenem or other beta-lactam agents. If an allergic reactions occurs, CAVUMOX must be discontinued immediately and appropriate alternative therapy instituted.

Care should be taken in patients with phenylketonuria as CAVUMOX contains aspartame.

INTERACTIONS WITH OTHER MEDICAMENTS

Oral anticoagulants

Oral anticoagulants and penicillin antibiotics have been widely used in practice without reports of interaction. However, in the literature there are cases of increased international normalised ratio in patients maintained on acenocoumarol or warfarin and prescribed a course of amoxicillin. If co-administration is necessary, the prothrombin time or international normalised ratio should be carefully monitored with the addition or withdrawal of amoxicillin. Moreover, adjustments in the dose of oral anticoagulants may be necessary.

Methotrexate

Penicillins may reduce the excretion of methotrexate causing a potential increase in toxicity.

Probenecid

Concomitant use of probenecid is not recommended. Probenecid decreases the renal tubular secretion of amoxicillin. Concomitant use of probenecid may result in increased and prolonged blood levels of amoxicillin but not of clavulanic acid.

Mycophenolate mofetil

In patients receiving mycophenolate mofetil, reduction in pre-dose concentration of the active metabolite mycophenolic acid (MPA) of approximately 50% has been reported following commencement of oral amoxicillin plus clavulanic acid. The change in pre-dose level may not accurately represent changes in overall MPA exposure. Therefore, a change in the dose of mycophenolate mofetil should not normally be necessary in the absence of clinical evidence of graft dysfunction. However, close clinical monitoring should be performed during the combination and shortly after antibiotic treatment.

PREGNANCY AND LACTATION

Pregnancy

Animal studies do not indicate direct or indirect harmful effects with respect to pregnancy, embryonal/foetal development, parturition or postnatal development. Limited data on the use of amoxicillin/clavulanic acid during pregnancy in humans do not indicate an increased risk of congenital malformations. In a single study in women with preterm, premature rupture

of the foetal membrane it was reported that prophylactic treatment with amoxicillin/clavulanic acid may be associated with an increased risk of necrotising enterocolitis in neonates. Use should be avoided during pregnancy, unless considered essential by the physician.

Breastfeeding

Both substances are excreted into breast milk (nothing is known of the effects of clavulanic acid on the breast-fed infant). Consequently, diarrhoea and fungus infection of the mucous membranes are possible in the breast-fed infant, so that breast-feeding might have to be discontinued. The possibility of sensitisation should be taken into account. Amoxicillin/clavulanic acid should only be used during breast-feeding after benefit/risk assessment by the physician in charge.

SIDE EFFECTS

The most commonly reported adverse drug reactions (ADRs) are diarrhoea, nausea and vomiting.

<u>Infection and infestation</u>	
Mucocutaneous candidosis	Common
Overgrowth of non-susceptible organisms	Not known
<u>Blood and lymphatic system disorders</u>	
Reversible leucopenia (including neutropenia)	Rare
Thrombocytopenia	Rare
Reversible agranulocytosis	Not known
Haemolytic anaemia	Not known
Prolongation of bleeding time and prothrombin time ¹	Not known
<u>Immune system disorders¹⁰</u>	
Angioneurotic oedema	Not known
Anaphylaxis	Not known
Serum sickness-like syndrome	Not known
Hypersensitivity vasculitis	Not known
<u>Nervous system disorders</u>	
Dizziness	Uncommon
Headache	Uncommon
Reversible hyperactivity	Not known
Convulsion ²	Not known
Aseptic meningitis	Not known
<u>Gastrointestinal disorders</u>	
Diarrhoea	Common
Nausea ³	Common
Vomiting	Common
Indigestion	Uncommon
Antibiotic-associated collitis ⁴	Not known
Black hairy tongue	Not known
Tooth discolouration ¹¹	Not known
<u>Hepatobiliary disorder</u>	

Rises in AST and/or ALT ⁵	Uncommon
Hepatitis ⁶	Not known
Cholestatic jaundice ⁶	Not known
<u>Skin and subcutaneous tissue disorders</u> ⁷	
Skin rash	Uncommon
Pruritus	Uncommon
Urticaria	Uncommon
Erythema multiforme	Rare
Stevens-Johnson syndrome	Not known
Toxic epidermal necrolysis	Not known
Bullous exfoliative-dermatitis	Not known
Acute generalised exanthemous pustulosis (AGEP) ⁹	Not known
Drug reaction with eosinophilia and systemic symptoms (DRESS)	Very rare
<u>Renal and urinary disorders</u>	
Interstitial nephritis	Not known
Crystalluria ⁸	Not known
<p>¹See section Warnings and Precautions</p> <p>²See section Warnings and Precautions</p> <p>³Nausea is more often associated with higher oral doses. If gastrointestinal reactions are evident, they may be reduced by taking amoxicillin/clavulanic acid with a meal.</p> <p>⁴Including pseudomembranous colitis and haemorrhagic colitis.</p> <p>⁵A moderate rise in AST and/or ALT has been noted in patients treated with beta-lactam class antibiotics, but the significance of these findings is unknown.</p> <p>⁶These events have been noted with other penicillins and cephalosporins.</p> <p>⁷If any hypersensitivity dermatitis reaction occurs, treatment should be discontinued.</p> <p>⁸See section Symptoms and Overdosage</p> <p>⁹See section Warnings and Precautions</p> <p>¹⁰ See section Contraindications & Warnings and Precautions</p> <p>¹¹Superficial tooth discolouration has been reported very rarely in children. Good oral hygiene may help to prevent tooth discolouration as it can usually be removed by brushing.</p>	

SYMPTOMS AND TREATMENT OF OVERDOSE

Symptoms and signs of overdose

Gastrointestinal symptoms and disturbance of the fluid and electrolyte balances may be evident. Amoxicillin crystalluria, in some cases leading to renal failure, has been observed.

Convulsions may occur in patients with impaired renal function or in those receiving high doses.

Amoxicillin has been reported to precipitate in bladder catheters, predominantly after intravenous administration of large doses. A regular check of patency should be maintained.

Treatment of intoxication

Gastrointestinal symptoms may be treated symptomatically, with attention to the water/electrolyte balance.

Amoxicillin/clavulanic acid can be removed from the circulation by haemodialysis.

EFFECTS ON ABILITY TO DRIVE AND USE MACHINE

No studies on the effects on the ability to drive and use machines have been performed. However, undesirable effects may occur (e.g., allergic reactions, dizziness, convulsions), which may influence the ability to drive and use machines.

STORAGE CONDITIONS

Dry powder:

Store in a dry place below 25°C in the original packaging to protect from light and moisture.

Reconstituted solution:

Once reconstituted, the suspension must be stored in a refrigerator (2°C to 8°C) and used within 5 days. Do not freeze.

DOSAGE FORMS AND PACKAGING AVAILABLE

Amber glass bottle containing powder for reconstitution with an aluminium screw cap per unit box.

Each bottle is supplied with a plastic measuring cup.

DATE OF REVISION OF PI

Date of revision: 18/05/2023

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