

= Clindamycin =

Clindamycin is an antibiotic useful for the treatment of a number of bacterial infections . This includes middle ear infections , bone or joint infections , pelvic inflammatory disease , strep throat , pneumonia , and endocarditis among others . It can be useful against some cases of methicillin @-@ resistant *Staphylococcus aureus* ( MRSA ) . It may also be used for acne and in addition to quinine for malaria . It is available by mouth , intravenously , and as a cream to be applied to the skin or in the vagina .

Common side effects include nausea , diarrhea , rash , and pain at the site of injection . It increases the risk of *Clostridium difficile* colitis about fourfold . Other antibiotics may be recommended instead due to this reason . It appears to be generally safe in pregnancy . It is of the lincosamide class and works by blocking bacteria from making protein .

Clindamycin was first made in 1967 . It is on the World Health Organization 's List of Essential Medicines , the most important medication needed in a basic health system . It is available as a generic medication and is not very expensive . The wholesale cost in the developing world is about 0 @. @ 06 to 0 @. @ 12 USD per pill . In the United States it costs about 2 @. @ 70 USD a dose .

= = Medical uses = =

Clindamycin is used primarily to treat anaerobic infections caused by susceptible anaerobic bacteria , including dental infections , and infections of the respiratory tract , skin , and soft tissue , and peritonitis . In people with hypersensitivity to penicillins , clindamycin may be used to treat infections caused by susceptible aerobic bacteria , as well . It is also used to treat bone and joint infections , particularly those caused by *Staphylococcus aureus* . Topical application of clindamycin phosphate can be used to treat mild to moderate acne .

= = = Acne = = =

The use of clindamycin in conjunction with benzoyl peroxide is more effective in the treatment of acne than the use of either product by itself .

Clindamycin and adapalene in combination are also more effective than either drug alone , although adverse effects are more frequent .

= = = Susceptible bacteria = = =

It is most effective against infections involving the following types of organisms :

Aerobic Gram @-@ positive cocci , including some members of the *Staphylococcus* and *Streptococcus* ( e.g. *pneumococcus* ) genera , but not enterococci .

Anaerobic , Gram @-@ negative rod @-@ shaped bacteria , including some *Bacteroides* , *Fusobacterium* , and *Prevotella* , although resistance is increasing in *Bacteroides fragilis* .

Most aerobic Gram @-@ negative bacteria ( such as *Pseudomonas* , *Legionella* , *Haemophilus influenzae* and *Moraxella* ) are resistant to clindamycin , as are the facultative anaerobic *Enterobacteriaceae* . A notable exception is *Capnocytophaga canimorsus* , for which clindamycin is a first @-@ line drug of choice .

The following represents MIC susceptibility data for a few medically significant pathogens .

*Staphylococcus aureus* : 0 @. @ 016 ?g / ml - > 256 ?g / ml

*Streptococcus pneumoniae* : 0 @. @ 002 ?g / ml - > 256 ?g / ml

*Streptococcus pyogenes* : < 0 @. @ 015 ?g / ml - > 64 ?g / ml

= = = D @-@ Test = = =

When testing a Gram @-@ positive culture for sensitivity to clindamycin , it is common to perform a " D @-@ Test " to determine if there is a macrolide @-@ resistant subpopulation of bacteria present

. This test is necessary because some bacteria express a phenotype known as MLSB , in which susceptibility tests will indicate the bacteria are susceptible to clindamycin , but in vitro the pathogen displays inducible resistance .

To perform a D @-@ test , an agar plate is inoculated with the bacteria in question and two drug @-@ impregnated disks ( one with erythromycin , one with clindamycin ) are placed 15 ? 20 mm apart on the plate . If the area of inhibition around the clindamycin disk is " D " shaped , the test result is positive and clindamycin should not be used due to the possibility of resistant pathogens and therapy failure . If the area of inhibition around the clindamycin disk is circular , the test result is negative and clindamycin can be used .

= = = Malaria = = =

Given with chloroquine or quinine , clindamycin is effective and well tolerated in treating Plasmodium falciparum malaria ; the latter combination is particularly useful for children , and is the treatment of choice for pregnant women who become infected in areas where resistance to chloroquine is common . Clindamycin should not be used as an antimalarial by itself , although it appears to be very effective as such , because of its slow action . Patient @-@ derived isolates of Plasmodium falciparum from the Peruvian Amazon have been reported to be resistant to clindamycin as evidenced by in vitro drug susceptibility testing .

= = = Other = = =

Clindamycin may be useful in skin and soft tissue infections caused by methicillin @-@ resistant Staphylococcus aureus ( MRSA ) ; many strains of MRSA are still susceptible to clindamycin ; however , in the United States spreading from the West Coast eastwards , MRSA is becoming increasingly resistant .

Clindamycin is used in cases of suspected toxic shock syndrome , often in combination with a bactericidal agent such as vancomycin . The rationale for this approach is a presumed synergy between vancomycin , which causes the death of the bacteria by breakdown of the cell wall , and clindamycin , which is a powerful inhibitor of toxin synthesis . Both in vitro and in vivo studies have shown clindamycin reduces the production of exotoxins by staphylococci ; it may also induce changes in the surface structure of bacteria that make them more sensitive to immune system attack ( opsonization and phagocytosis ) .

Clindamycin has been proven to decrease the risk of premature births in women diagnosed with bacterial vaginosis during early pregnancy to about a third of the risk of untreated women .

The combination of clindamycin and quinine is the standard treatment for severe babesiosis .

Clindamycin may also be used to treat toxoplasmosis , and , in combination with primaquine , is effective in treating mild to moderate Pneumocystis jirovecii pneumonia .

= = Adverse effects = =

Common adverse drug reactions associated with systemic clindamycin therapy ? found in over 1 % of people ? include : diarrhea , pseudomembranous colitis , nausea , vomiting , abdominal pain or cramps and / or rash . High doses ( both intravenous and oral ) may cause a metallic taste . Common adverse drug reactions associated with topical formulations - found in over 10 % of people - include : dryness , burning , itching , scaliness , or peeling of skin ( lotion , solution ) ; erythema ( foam , lotion , solution ) ; oiliness ( gel , lotion ) . Additional side effects include contact dermatitis . Common side effects - found in over 10 % of people - in vaginal applications include fungal infection .

Pseudomembranous colitis is a potentially lethal condition commonly associated with clindamycin , but which occurs with other antibiotics , as well . Overgrowth of Clostridium difficile , which is inherently resistant to clindamycin , results in the production of a toxin that causes a range of adverse effects , from diarrhea to colitis and toxic megacolon .

Rarely ? in less than 0 @. @ 1 % of patients ? clindamycin therapy has been associated with anaphylaxis , blood dyscrasias , polyarthrititis , jaundice , raised liver enzyme levels , renal dysfunction , cardiac arrest , and / or hepatotoxicity .

= = Interactions = =

Clindamycin may prolong the effects of neuromuscular @-@ blocking drugs , such as succinylcholine and vecuronium . Its similarity to the mechanism of action of macrolides and chloramphenicol means they should not be given simultaneously , as this causes antagonism and possible cross @-@ resistance .

= = Chemistry = =

Clindamycin is a semisynthetic derivative of lincomycin , a natural antibiotic produced by the actinobacterium *Streptomyces lincolnensis* . It is obtained by 7 ( S ) -chloro @-@ substitution of the 7 ( R ) -hydroxyl group of lincomycin . The synthesis of clindamycin was first announced by BJ Magerlein , RD Birkenmeyer , and F Kagan on the fifth Interscience Conference on Antimicrobial Agents and Chemotherapy ( ICAAC ) in 1966 . It has been on the market since 1968 .

= = Mechanism of action = =

Clindamycin has a primarily bacteriostatic effect . It is a bacterial protein synthesis inhibitor by inhibiting ribosomal translocation , in a similar way to macrolides . It does so by binding to the 50S rRNA of the large bacterial ribosome subunit .

The structures of the complexes between several antibiotics ( including clindamycin ) and a *Deinococcus radiodurans* ribosome have been solved by X @-@ ray crystallography by a team from the Max Planck Working Groups for Structural Molecular Biology , and published in the journal *Nature* .

= = Society and culture = =

= = = Cost = = =

It is available as a generic medication and is not very expensive . The wholesale cost in the developing world is about 0 @. @ 06 to 0 @. @ 12 USD per pill . In the United States it costs about 2 @. @ 70 USD a dose .

The wholesale price in UK is less than 5 pence per pill , however the RX system covers the cost for citizens . Canada and Mexico also have a similar cost , with average price of 4 cents per pill .

= = = Available forms = = =

Clindamycin preparations for oral administration include capsules ( containing clindamycin hydrochloride ) and oral suspensions ( containing clindamycin palmitate hydrochloride ) . Oral suspension is not favored for administration of clindamycin to children , due to its extremely foul taste and odor . Clindamycin is formulated in a vaginal cream and as vaginal ovules for treatment of bacterial vaginosis . It is also available for topical administration in gel form , as a lotion , and in a foam delivery system ( each containing clindamycin phosphate ) and a solution in ethanol ( containing clindamycin hydrochloride ) and is used primarily as a prescription acne treatment .

Several combination acne treatments containing clindamycin are also marketed , such as single @-@ product formulations of clindamycin with benzoyl peroxide ? sold as BenzaClin ( Sanofi @-@ Aventis ) , Duac ( a gel form made by Stiefel ) , and Acanya , among other trade names ? and , in the United States , a combination of clindamycin and tretinoin , sold as Ziana . In India , vaginal

suppositories containing clindamycin in combination with clotrimazole are manufactured by Olive Health Care and sold as Clinsup @-@ V. In Egypt , vaginal cream containing clindamycin produced by Biopharmgroup sold as Vagiclind indicated for vaginosis .

Clindamycin is available as a generic drug , for both systemic ( oral and intravenous ) and topical use ( The exception is the vaginal suppository , which is not available as a generic in the USA ) .

Clindamycin is marketed as generic and under trade names including Cleocin HCl , Dalacin , Lincocin ( Bangladesh ) , Dalacin , and Clindacin . Combination products include Duac , BenzaClin , Clindoxyl and Acanya ( in combination with benzoyl peroxide ) , and Ziana ( with tretinoin ) .

= = Veterinary use = =

The veterinary uses of clindamycin are quite similar to its human indications , and include treatment of osteomyelitis , skin infections , and toxoplasmosis , for which it is the preferred drug in dogs and cats . Toxoplasmosis rarely causes symptoms in cats , but can do so in very young or immunocompromised kittens and cats .