Vancomycin Mechanism

PLAY PICMONIC

Vancomycin is a glycopeptide antibiotic used in the treatment of gram positive bacterial infections. This antibiotic was originally indicated for treatment of penicillin resistant Staphylococcus aureus. Traditionally, it has been reserved for a drug of last resort, only after treatment with other antibiotics failed. Today vancomycin resistant organisms are increasing and becoming more common. This antibiotic inhibits the cell wall mucopeptide synthesis via forming hydrogen bond interactions with the terminal D-alanyl-D alanine moieties of the cell wall peptides. This binding to the D-Ala-D-Ala prevents synthesis of long polymers of N-acetylmuramic acid and N-acetylglucobsamine which forms the backbone strands of the bacterial cell wall and also prevents the polymers from forming cross links. Resistance to vancomycin develops when the D-Ala-D-Ala moiety changes to D-ala-D-lac, preventing binding of vancomycin. Because gram negative bacteria produce their cell walls via a different mechanism, vancomycin is not active against gram negative bacteria. Overall, this antibiotic is indicated for the treatment of serious life threatening infections caused by susceptible organisms including methicillin resistant Staph aureus, treatment of pseudomembranous colitis caused by the bacteria Clostridium difficile, and enterococci infections resistant to other penicillin derivatives. Well known adverse reactions associated with IV vancomycin include thrombophlebitis, nephrotoxicity, ototoxicity and diffuse flushing commonly called “red man syndrome”. Therefore vancomycin must be administered slowly in a dilute solution. Red man syndrome typically appears within 10 minutes after infusion and is characterized by flushing or an erythematous rash of the face, neck and torso due to nonspecific mast cell degranulation. Therefore, symptoms may be treated or prevented with antihistamines and are less likely to occur with a slow infusion rate.

Bacteriostatic and Bactericidal

Bacteria-shocked and Bacteria-sliders

Vancomycin has been shown to have bacteriostatic activity against various strains of C. difficile. This has changed, as this drug was previously bactericidal to this bacteria. This drug still maintains bactericidal activity against Staph aureus.

Gram-Positive

Graham-cracker Positive-angel

Because gram negative bacteria produce their cell walls via a different mechanism, vancomycin is not active against gram negative bacteria and only has antibiotic effects on gram positive organisms.

Inhibits Cell Wall Mucopeptide

Wall of mucous Peptide-cans

This antibiotic inhibits the cell wall mucopeptide synthesis via forming hydrogen bond interactions with the terminal D-alanyl-D alanine moieties of the cell wall peptides. This binding to the D-Ala-D-Ala prevents synthesis of long polymers of N-acetylmuramic acid and N-acetylglucosamine which forms the backbone strands of the bacterial cell wall and also prevents the polymers from forming cross links.

Binds to D-ala D-ala

D-Ala and D-Ala binding to Van-tank-mice

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Resistance with Change to D-ala D-lac

Last Aladdin is changed to bLack wearing Resistance-bandana

Resistance to vancomycin develops when the D-Ala-D-Ala moiety changes to D-ala-D-lac, preventing binding of vancomycin.

Staphylococcus aureus

Staff of Oreos

Vancomycin is commonly used in the treatment of Staph aureus infections that are highly resistant to penicillin derivatives including MRSA (methicillin resistant Staph aurues). Staphylococcus aureus is a gram positive cocci that can cause a wide range of illnesses from minor skin infections to life-threatening diseases like pneumonia, osteomyelitis, and endocarditis.

Orally for Clostridium difficile

Mouth and Classroom with Difficult-equation chalkboard

Vancomycin is indicated in pseudomembranous colitis infections caused by Clostridium difficile when the infection is unresponsive to metronidazole treatment. For this indication, vancomycin is given orally rather than the typical IV route.

Enterococci

Intestines-cock-eyed

Enterococci are gram positive cocci that were previously classified as Group D streptococcus due to Lancefield group D classification. Important clinical infections caused by Enterococcus species include urinary tract infections and subacute endocarditis. An important feature of this genus is a high level of antibiotic resistance. Many enterococci are intrinsically resistant to beta lactam antibiotics and resistance to vancomycin (VRE) has been increasing in the last few decades.