Imagine going to the doctor to be treated for a normally treatable infection only to find that no effective treatments exist because all conventional antibiotics are ineffective. In some regions of the world, antibiotic prescription isn’t regulated and overuse has led to antibiotic resistance. Carbapenems are a class of antibiotics that inhibit bacterial cell wall synthesis and are often used as a last resort treatment for bacterial infections. New Delhi Metallo-β-lactamase-1 (NDM-1) is an enzyme that occurs in several types of bacteria and conveys resistance against carbapenems. The mechanisms of action of NDM-1 carbapenemase have played a large role in introducing the NDM-1 enzyme into the deadly superbug it is today. Vacation and business travel into the deadly superbug it is today. Vaccination and business travel into the deadly superbug it is today. Researchers were examining the effects of the concentration of tigecycline (a β-lactam antibiotic) on the hydrolysis of carbapenems. NDM-1 is an enzyme found in some bacteria that can make infections untreatable with the most effective antibiotics. It was first discovered in December, 2008 in a Swedish man with Klebsiella pneumoniae who had been treated in New Delhi when he contracted an infection that was resistant to a broad range of β-lactam antibiotics. Many regions in India, prescription medicine isn’t regulated, and prescription drugs can be purchased at will and used in any amount for any period of time. Misuse of these antibiotics in countries such as this has enabled bacteria to evolve into the deadly superbug it is today. The emergence of NDM-1 was discovered in 1976 and served as a model for all subsequent carbapenems.

**Abstract**

Carbapenems are a class of intravenously administered antibiotics that are typically used to treat infections where other antibiotics have failed. They are characterized by their presence at the core of their molecular structure much like penicillin but have chemical differences that make them resistant to most β-lactamases. This makes them an ideal candidate for treatment for bacterial infections that possess β-lactamases that confer resistance to penicillin. Carbapenems function in much the same way as penicillin; they bind to Penicillin Binding Proteins (PBPs) within a bacterium which in turn prevents that bacterium from catalyzing the formation of peptidoglycan, a key component of the bacterial cell wall. With no ability to synthesize peptidoglycan, the cell wall eventually dissolves and rapidly kills the bacterium. Peptidoglycan’s universal use in bacteria makes carbapenems effective against a large variety of both Gram-positive and Gram-negative bacteria. The first carbapenem, thienamycin, was discovered in 1976 and served as a model for all subsequent carbapenems.

**Evolution of NDM-1**

Anatomy of NDM-1

New Delhi Metallo-β-lactamase (NDM-1) is an enzyme found in some bacteria that can make infections untreatable with most carbapenem antibiotics. It was first discovered in December, 2008 in a Swedish man with Klebsiella pneumoniae who had been treated in New Delhi when he contracted an infection that was resistant to a broad range of β-lactam antibiotics. Many regions in India, prescription medicine isn’t regulated, and prescription drugs can be purchased at will and used in any amount for any period of time. Misuse of these antibiotics in countries such as this has enabled bacteria to evolve into the deadly superbug it is today. The emergence of NDM-1 was discovered in 1976 and served as a model for all subsequent carbapenems.

**Horizontal Gene Transfer**

Horizontal gene transfer (HGT) is the movement of genes between organisms that differ from a common ancestor. It refers to the movement of genetic information without bearing any novel offspring. The gene for NDM-1, for example, is passed along through horizontal gene transfer. There are several ways HGT can happen. This includes transformation (a cell taking in genetic material) and transduction (a bacteria gives DNA to another bacteria). The gene for NDM-1 is found on a ring of bacterial DNA known as a plasmid that is commonly transferred between bacteria. This phenomenon is responsible for NDM-1’s appearance in several different species of bacteria. HGT is the primary reason bacteria can resist drugs, playing a major role in the evolution of bacteria.

**Conclusion**

- Carbapenems are a category of antibiotics typically used as a last resort in persistent infections.
- Overuse/improper use of antibiotics gives bacteria an opportunity to evolve resistance to them.
- NDM-1 is an antibiotic resistance gene confers resistance to most carbapenems.
- Zinc ions within NDM-1’s active site bind and sever the β-lactam ring on carbapenems, inhibiting their antibiotic properties.
- NDM-1 is located on a plasmid that is typically transferred by horizontal gene transfer from one bacterium to another.
- Understanding the function of NDM-1 could help prevent a potential outbreak of dangerous bacterial