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Cell wall synthesis inhibitors:
Cell wall synthesis inhibitors are a class of antibiotics that possess their pharmacological activity by the mechanism of inhibition of cell wall in bacteria. These antibiotics include penicillin, cephalosporin, and other beta-lactam antibiotics. For proper understanding of the underlying mechanism of cell wall synthesis inhibitors it's worthwhile to have a view of cell wall synthesis in bacteria.

Classification:
As the name indicates these antimicrobial prevent cell wall formation of the infectious microbes, thus leading to cell lysis and so on, the death of microbe. Antibiotics included in this class includes the following list:

- penicillin
- cephalosporin
- monobactam
- aztreonam
- bacitracin
- vancomycin

Theory of cell wall synthesis in bacteria:
The cell wall is a rigid structure unique to bacterial species. It completely surrounds the cytoplasmic membrane, maintains cell shape and integrity. And prevent cell lysis from high osmotic pressure. The cell wall is composed of a complex, cross-linked polymer of polysaccharide and polypeptide peptidoglycans also known as murein or mucopeptide. The polypeptide contains alternating amino sugars, N-acetyl glucosamine, and N-acetyl muramic acids. These two building blocks are collectively called NAM, NAG units. The cross-linking of these units is responsible for giving structural rigidity to the cell.

Following are the detailed steps of cell wall formation mechanism in bacteria;
The first step is the binding of 5-amino acid peptide with NAM unit. The 5 amino acids can be D-alanyl or D-alanine.

The next step of cell wall synthesis is the transport of this building block from the inside of the cell to outside for formation of the cell wall. This process is mediated by a phosphate transporter.

The 3rd step is the glycosylation of adjacent NAM, NAG units for continuing cell wall synthesis. Here is when the cell wall synthesis begins the primary layer of the cell wall.

The final step in cell wall synthesis is the formation of cross-linkages between adjacent cell wall layers. The enzyme responsible for this is transpeptidases also known as penicillin-binding proteins (Because penicillin binds here as an antagonist to cause its bactericidal action). Transpeptidases removes the terminal alanine from peptides of terminal NAM, NAG units and thus facilitate their cross-linkages with each other.

**Mechanism of cell wall synthesis inhibitors:**
Antibiotics may follow different routes for inhibition of cell wall synthesis in bacteria. They can alter any of the four events of cell wall synthesis for producing its effect of cell wall synthesis inhibition and hence bactericidal or bacteriostatic action.

For instance, cycloserine is an antibiotic that prevents amino acid peptides from binding to NAM, NAG units and thus altering the very first step. Similarly, bactericin alter the second step that is NAM, NAG unit migration from inside of the cell to outside. Vancomycin inhibits glycosylation by inhibiting various glycosylases enzymes. Last but not least is beta-lactam antibiotics that prevent cross-linking by inhibiting transpeptidation and transcarboxylation by binding to the responsible enzymes. These enzymes are called penicillin-binding proteins.

**Clinical Uses:**
Cell wall synthesis inhibitors are administered in;

- Bacterial meningitis
- Bone and joints infections
- Skin and soft tissues infection
- Pharyngitis
- Bronchitis
- Pneumonia
- Urinary Tract (UT) infections
- Gonorrhea
- Syphilis
- Endocarditis
Adverse effects

Adverse effects are very rare; they may include hypersensitivity reactions that occur in 10% patients. Other adverse effects include:

- GIT disturbances
- Neurotoxicities
- Nephrotoxicity
- Cationic toxicity.
- Bronchospasm
- Hypotensions
- Angioedema
- Laryngospasm
- And Rashes

After test dose (ATD) is important in case of penicillin.

Allergic Reactions Associated With Cell Wall synthesis Inhibitors Especially penicillin:

Allergic reactions may occur leading to anaphylactic shock. Allergic reactions are more prominent in case of penicillin. The allergic responses arising may be classified into; class I, class II, class III, and class IV hypersensitivity reactions.

Type II-mediated allergic reactions lead to cytotoxicities, causing hemolytic anemia, neutropenia, thrombocytopenia etc.

Type III-mediated allergic reactions involve immunocomplex formation and their deposition.

These may cause; vasculitis, pericarditis, glomerular nephritis, generalized lymphadenopathy, and polyarthritis.

Most of these allergic reactions are associated with beta-lactams among the cell wall synthesis inhibitors.

Management of hypersensitivities:

Pre-administration:

Pre-administration requirements are skin test or clinical history. The penicillin use should be avoided if the test is positive.

Post-administration:

A post administration dose is given when the allergic reaction is likely to occur or it has occurred. The post administration requirements include; adrenaline, 0.3-0.5 ml (1:1000 dilution) administered subcutaneously.

Steroids, 100-200 mg hydrocortisone, and antiallergics.
Git Disturbances:

Git disturbances are associated with almost all antibiotics especially the broad spectrum. Normal flora suppresses pathogens by competing with them for nutrients. Antibiotics can wipe the normal beneficial flora of human GIT system. As a result, opportunistic infections can occur.