Pharmacology of pencillin | pharmacology notes:

Introduction:
Pencillin is a group of variable spectrum antibiotics possessing bactericidal action via the mechanism of cell wall synthesis inhibition. Pencillin is obtained either from natural and semisynthetic source.

It has high therapeutic index i.e a broader margin of safety.

Naturally pencillin is obtained from filamentous fungi *pencillium crysogenum/notatum*.

In 1928 pencillin was discovered accidently by Alexander fleming when he was working on growth of staphylococci. He named it pencillin but he did not isolated it.

Later on chain & flory supplied pencillin in bulk for the first time. Both of them were awarded nobel prize.

Chemistry of pencillin:
The basic nucleus of pencillin is 6-amino-pencillinic acid.

The pencillin’s dual ringed structure consists of thazolidine ring and beta lactam ring. On this basis pencillin is classified under beta lactam antibiotic. The R group attached to beta lactam ring is of crucial importance.

The alkyl group is responsible for various prominent feature of beta lactam antibiotics some of which.

- Spectrum of antibiotics
- Pencillinase sensitivity
- Pharmacokinetic activity

if R is hydrophilic in nature the antibiotic will be considered broad spectrum antibiotic. The R group also determines the activity of pencillinase. For instance when alkyl group is a small group the antibiotic will be pencillinase sensitive i.e will respond to pencillinase
enzyme. On the other hand if R (alkyl group) is a bulky group then the antibiotic will be pencillinase non sensitive.

In pencillin-G the R group is a benzyl group (small group) so pencillin-G is pencillinase non-resistant.

Another example is that of Ampicillin in which R is alpha amino benzyl group, And in amoxicillin R group is alpha amino phenol. In oxacillin the R group is 5-methyl-3-phenyl 4-isoxazolyl.

**Classification of pencillin:**
The classification of pencillin is done on the basis of their sensitivity toward pencillinase. This way pencillin may be classified into;

- Pencillinase sensitive pencillins
- Pencillinase resistant pencillins

**Pencillinase sensitive pencillins:**
Pencillinase sensitive pencillins may further be subdivided into;

1. Short acting pencillins
2. Long acting pencillins
3. Acid resistant pencillins
4. Amino pencillins
5. Carboxy pencillins

This classification is a blend nature based and action based classification

**Short acting pencillins:**
Short acting pencillins includes Pencillin-G (benzyl pencillin).

Pencillin-G is administered both as IV or IM injectables. It has an action time of 4-6 hours and reach the maximum plasma concentration in this time.

**Long acting pencillins:**
Long acting pencillins include procaine pencillin and benzathine pencilline. For procain pencilline the duration of action is 12-24 hours & for benzathine pencilline it is from 3 to 4 weeks.

Due to a very large duration of action benzathine pencillin is also known as depot pencillin or repository pencillin. Long acting pencillin is only administered as intramuscular injections.
**Acid resistant pencillins:**
Acid resistant pencillins include pencillin-V, phenobencillin and propicillin.

**Amino pencillins:**
Amino pencillins is a clinically important class of pencillins. It include majority of the commonly used antibiotics. Following are examples of amino pencillins.

*Amoxicilline (penbritin®), amoxicillin (amoxil®) and ampicillin pro-drugs are included in amino pencillins.*

Ampicillin pro-drugs include becampicillin, pivampicilline and telampicillin. This means that these drugs when administered will convert into their active form i.e ampicillin.

Amino pencillins are generally administered in combination therapy generally with **Beta lactamase inhibitors**. 3 beta lactamase inhibitors are in practice for combination with amino pencillins. They are;

Salbactam, tazobactam and clavulonic acid. Remember them with the **Mnemonic “STC”**. Co-amoxiclave (augmentin®) is a combination therapy including amoxicillin as the antibiotic and clavulonic acid as the beta-lactamase inhibitor.

Another example is that of ampiclox which is a combination of ampicilline and cloxacillin.

**Carboxy pencillins:**
Carboxy pencillins include;

- Ticarcillin
- Ticarcilline+clavulonic acid (ticar®)
- Carbencillin
- Carbencillin indanyl
- Carfecillin

**Pencillinase resistant pencillins:**
Pencillinase resistant pencillins are not effected by pencillinase. This class include;

- methicillin,
- nafcelline,
- oxacilline,
- cloxacilline and
• dicloxacillin.

Remember them with the mnemonic **MNOCDF**.