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Department: Anatomy

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Course: System Pharmacology

1. Name of the drug

**Nitrofurantoin** is a nitrofuran antibiotic used to treat and prevent urinary tract infection.

 It works by killing bacteria that causes infection. Nitrofurantoin is more resistant to the development of bacterial resistance because it acts on many targets at once.

 Nitrofurantoin is converted by bacterial nitroreductases to electrophilic intermediates which inhibit the citric acid cycle as well as synthesis of DNA, RNA, and protein. Nitrofurantoin is a second line treatment to trimethoprim/sulfamethoxazole. This is one of the few drugs commonly used to treat urinary tract infections in pregnancy. However, should not be used in late pregnancy to avoid putting the newborn at the potential risk of Hemolytic Anemia. This drug should not be taken if the patient has a severe kidney disease, urination problems, or a history of jaundice or liver problems caused by nitrofurantoin.

1. Antibacterial activity

It is bactericidal and has local effect by attacking bacteria present in urine. Nitrofurantoin interferes with the production of bacterial proteins, DNA and cell walls. It is effective against E.coli, Staphylococcus aureus, Enterobactercystitis, Enterococcus and Klebsiella.

1. Mechanism of action

It is activated inside the bacteria by reduction reaction via nitrofurantoin reductase to unstable metabolite, which disrupts ribosomal RNA, DNA and intracellular components. Intermediate metabolites that result from this reduction then bind to bacterial ribosome and inhibit bacterial enzymes involved in the synthesis of DNA, RNA, cell wall protein synthesis, and other metabolic enzymes. Remember, it is bactericidal, especially to bacteria present in acid urine.

1. Pharmacokinetics

Nitrofurantoin is a urinary tract antibacterial agent whose clinical effectiveness depends on the high urinary drug levels encountered during therapeutic drug dosage. Under these conditions, only low blood drug concentrations are usually found. This drug is well absorbed from the gut. On the basis of urinary nitrofurantoin excretion determined after oral and intravenous drug administration, orally administered nitrofurantoin in a suitable dosage form is well absorbed. In vitro testing does not accurately reflect nitrofurantoin bioavailability( up to 80%), which is affected by formulation differences, drug particle size, and dosage form. Nitrofurantoin is readily absorbed and quickly distributed into most body fluids. It is excreted largely unchanged in the urine, giving urinary concentrations high enough to treat lower urinary tract infections, but the low tissue concentrations are inadequate for the treatment of acute pyelonephritis. It is rapidly excreted in large amounts in bile and urine. With the exception of the active drug secretion in the kidney tubule and biliary drug transport, nitrofurantoin transfer across body membranes occurs by diffusion. Nitrofurantoin has a short elimination half-life( less than 1hour or < 1hour ) in whole blood or plasma and therapeutic plasma concentrations are not achieved. In conjunction with its rapid excretion by the primary routes, there is little evidence for any prolonged binding of nitrofurantoin to either plasma proteins or tissues. The first-order kinetics involved in nitrofurantoin absorption and elimination is most appropriately described by a one-compartment open model. Biliary and urinary excretion of unchanged nitrofurantoin and enzymatic degradation are the primary means of elimination.

1. Adverse effects.

Some of them are as follows:

1. Neuropathy (Nerve damage)

Some of the symptoms of neuropathy are as follows;

* Muscle weakness
* Tingling in your hands and feet or numbness
1. Pulmonary toxicity ( lung inflammation)

Symptoms include;

* Fever
* Chills
* Cough
* Shortness of breath
* Chest pain
1. Hepatotoxicity (Liver problems)

Symptoms include;

* Dark urine
* Loss of appetite
* Itching
* Nausea
* Yellowing of your skin or the whites of your eyes.

Other adverse effects include;

* Vomiting
* Lack of appetite
* Stomach pain
* Diarrhoea
* Weakness
* Numbness in hands and feet
* Pain in hands and feet.