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COURSE TITLE: SYSTEM PHARMACOLGY

**ASSIGMENT**

1. A drug used in the treatment of urinary tract infection causes brown coloration of urine. Explain in full detail the pharmacology of the drug under the following headings:

a. Name of the drug

b. Antibacterial activity

c.   Mechanism of action

d. Pharmacokinetics

e. Adverse effects

**ANSWER**

a. **NAME OF THE DRUG**

The name of the drug used in treatment of urinary tract infection that causes brown coloration of urine is called **NITROFURANTION [MACROBID]**

Nitrofurantoin is sold under the trade name **MARCOBID** among others. It is an antibiotic that fights bacteria in the body. Nitrofurantoin is used to treat uncomplicated urinary tract infection. Nitrofurantoin is a unique antibiotic characterized by a hydantoin ring with a nitro-substituted furanyl side chain that is metabolized within the bacteria to produce reactive compounds that are bactericidal.

b.  **ANTIBACTERIAL ACTIVITY**

The mechanism of antibacterial activity is not well understood but presumably occurs by altering ribosomal proteins and other important intracellular structures.

     Nitrofurantoin has a broad antibacterial activity but its use in small animals is limited to treatment of lower urinary tract infection.

• Nitrofurantoin has activity against several gram negative and some gram positive aerobic bacteria including many isolate of Escherichia, klebsiella, Enterobacter, enterococcus, staphylococcus and salmonella

• It has little or no activity most strains of proteus and no activity against pseudomonas.

• Nitrofurans have moderate activity against anaerobic bacteria and are most active in in anaerobic conditions. Some aerobic bacteria that are resistant under aerobic conditions are susceptible when tested under anerobic conditions.

c. **MECHANISM OF ACTION.**

The mechanism of action is complex and unique. The drug works by damaging bacterial DNA, since its reduced form is highly reactive. This is made possible by the rapid reduction of nitrofurantoin inside the bacterial cell by flavoproteins[ nitrofuran reductase] to multiple reactive intermediates that attack ribosomal proteins DNA, respiration pyruvate metabolism and other macromolecules within the cell. As a result of such inactivation/ reduction the vital biochemical processes of protein synthesis, aerobic energy metabolism, DNA synthesis, RNA synthesis and cell wall synthesis are inhibited. Nitrofurantoin exerts greater effects on bacterial cells than mammalian cells because bacterial cells activate the drug more rapidly.

d. **PHARMOKINETICS**

Nitrofurantoin is administered orally as microcrystalline or macrocrystalline formulation, of which the latter has a slower absorption rate. Absorption is almost complete, with 2-4% of the dose being recovered from the feces. Serum concentration are not measurable, except in patient who have severe renal failure. This is because of destruction of nitrofurantoin in the tissues and, in particular , a very rapid renal elimination by glomerular filtration[20%] and tubular secretion, resulting in a serum half-life of only 20minutes in patient who have normal renal function. Excretion is complete within 6 hours after intake and urine concertation of 200-400mg/l are achieved after a dose of 100mg q8h. in patient who have renal failure- who should not be given nitrofurantoin- there are measurable but still very low serum and urine concentration.

Therapeutic doses of nitrofurantoin are 50- 100 mg q8h or q6h for adult and 3mg/kg/day q12h or q8h for children. Prophylactically, the adult dose is 50-100mg and the pediatric dose 1-2 mg/hg at bedtime. The duration of treatment when nitrofurantoin is used therapeutically should be 5-7 days. Dosages are not affected by liver function.

e. **ADVERSE EFFECT**

• Gastrointestinal intolerance: nausea, epigastric pain, diarrhea.

• Hypersensitivity: fever, chills

• Peripheral neuritis and other neurological effect with long term use.

• Hematologic disorder: leukopenia, granulocytopenia, hemolytic anemia in G6PD deficient patients.

• Liver damage, pulmonary reaction with fibrosis on chronic use