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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:

1. Name of the drug
2. Antibacterial activity
3. Mechanism of action
4. Pharmacokinetics
5. Adverse effects

**Name of the drug**

Nitrofurantoin is an antibiotic drug that causes coloration of urine during treatment of urinary tract infection. It is converted by bacterial nitroreductases to electrophilic intermediates which inhibits the citric acid cycle as well as synthesis of DNA, RNA, and protein. It is more resistant to bacterial resistance as it acts on many targets at once.

**Antibacterial Activity**

Nitrofurantoin interferes with the production of bacterial proteins, DNA, and cell walls. Sensitive bacteria reduce the drug to an active agent that inhibits various enzymes and damages DNA. It is effective against E.Coli, Enterococcus.

**Mechanism of Action**

Nitrofurantoin is activated inside bacteria by reduction via the flavoprotein nitrofurantoin reductase to unstable metabolites, which disrupts ribosomal RNA, DNA and other intracellular components.

**Pharmacokinetics**

Nitrofurantoin is well absorbed from the gut. Its half-life is very short (less than 1hr) and therapeutic plasma concentrations are not achieved. 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 treatments of acute pyelonephritis.

**Adverse Effect**

* Gastrointestinal upset is common, including anorexia, nausea and vomiting.
* Pulmonary toxicity with long-term use produces acute allergic pneumonitis or chronic interstitial fibrosis.
* Hepatotoxicity
* Peripheral neuropathy (numbness in your hands, muscle weakness)