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Medical Uses and Contradictions of Doxycycline

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Perspective

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DESCRIPTION

Doxycycline, a tetracycline family broad-spectrum antibiotic, is used to treat bacterial infections and some parasitic diseases. Acne, chlamydia infections, Lyme disease, cholera, typhus, and syphilis are among the conditions it is used to treat. When used with quinine, it is also used to prevent malaria. Doxycycline may be ingested or administered intravenously as an injection. Diarrhoea, nausea, vomiting, pain in the abdomen, and a higher risk of sunburn are typical adverse effects. It is not advised during pregnancy. It kills bacteria, same as other tetracycline-class medications, by blocking protein synthesis. The apicoplast, a plastid organelle, is the target, and it kills malaria. In 1967, doxycycline entered the market after being granted a patent in 1957. Generic versions of doxycycline are readily available. With more than 8 million prescriptions written in 2019, it was the 90th most often prescribed drug in the US. Doxycycline is widely used to treat Lyme disease, chronic prostatitis, sinusitis, pelvic inflammatory disease, acne, rosacea, and rickettsial infections in addition to the general indications for all tetracycline medicines. Like other tetracycline medicines, doxycycline has bacteriostatic properties. Through the suppression of protein synthesis, it stops bacteria from proliferating.

Due to its high lipophilicity and ease of cell entry, doxycycline is readily absorbed when taken orally and has a wide volume of distribution. Despite its high lipophilicity and propensity for re-absorption in the renal tubules and gastrointestinal tract, it does not accumulate in the kidneys of people with kidney failure because of compensatory excretion in faeces. More doxycycline enters the duodenum for absorption than the previous tetracycline compounds because doxycycline-metal ion complexes are unstable at acid pH. Furthermore, doxycycline decreases serum concentrations by about 20% compared to 50% for tetracycline, demonstrating that food had a less significant effect on absorption than prior medications. Doxycycline is an antibiotic with a broad spectrum. By

attaching to the bacterial only 30S ribosomal subunit, it prevents the synthesis of bacterial proteins. As a result, amino acids cannot be incorporated to polypeptide chains to form new proteins and transfer RNA cannot connect to messenger RNA at the ribosomal subunit. This halts the growth of the germs and gives the immune system time to eliminate them. Tetracyclines that have expired or that have been left to sit at a pH lower than 2 have been found to be nephrotoxic because they produce a breakdown product called anhydro-4-epitetracycline, which causes Fanconi syndrome. The lack of a hydroxyl group in C-6 in the case of doxycycline inhibits the development of the nephrotoxic molecule. Tetracyclines and doxycycline alone, however, need to be used cautiously in individuals with kidney damage since they can exacerbate azotemia due to catabolic effects. *In vitro* and *in vivo* biomedical research experiments using bacteria, as well as in experiments using eukaryotic cells and organisms with inducible protein expression systems using tetracycline-controlled transcriptional activation, doxycycline and other members of the tetracycline class of antibiotics are frequently used as research reagents. Tetracyclines' antibacterial impact is based on the disruption of protein translation in bacteria, which makes it difficult for microorganisms to grow and repair. However, protein translation is also affected in eukaryotic mitochondria, which affects metabolism and can skew experimental results.