Metronidazole

Metronidazole (trade name Flagyl) is an antibiotic used particularly for anaerobic bacteria and protozoa. In the organisms, metronidazole is taken up by diffusion and nonenzymatically reduced, forming free radical toxic metabolites. These metabolites form linkages with important enzymes and deactivate them. In addition, metronidazole metabolites are taken up into bacteria DNA and form unstable molecules that damage the DNA. Common infections treated by metronidazole include Giardia, Entamoeba, Trichomonas, Gardnerella, and anaerobic bacteria like Clostridium difficile. Common side effects include a metallic taste in the mouth and a disulfiram-like reaction with alcohol.



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Mechanism of Action

Bactericidal
Bacteria-sliders
Unlike bacteriostatic agents, which simply stop bacteria from reproducing, bactericidal agents actually cause bacterial cell death.

Forms Free Radical Toxic Metabolites
Free Oxygen Radical Metabolites
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 reduced, forming free-radical toxic metabolites. These metabolites form
 linkages with important enzymes and deactivate them. In addition,
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Damages DNA
Damaged DNA-double-helix
Cytotoxic-intermediate particles interact with host cell DNA, resulting in DNA strand breakage and fatal destabilization of the DNA helix.

Indications

Giardia lamblia
Jar Lamb
Giardia lamblia is a protozoan parasite that infects the small intestine causing giardiasis. Colonization of the gut results in severe inflammation and villous atrophy, causing reduced absorptive capability. Symptoms of infection include bloating, flatulence and foul smelling fatty diarrhea. This condition is usually self-limiting but can cause prolonged symptoms in the immunocompromised. Individuals with lack of IgA are especially prone to recurring Giardia infections and can develop chronic disease. Metronidazole is the current first-line therapy for Giardia infections.

Entamoeba Histolytica
Antennae on entamoeba
Metronidazole is used in the treatment of Entamoeba. Entamoeba histolytica is a protozoan that causes the disease amebiasis. Infection can cause bloody diarrhea or result in a liver abscess. Inside the digestive tract, trophozoites are capable of invading the intestinal wall causing flask shaped ulcers and can reach the bloodstream. From there, the protozoa can reach different organs including the liver. A common outcome of this invasion is a liver abscess that has the appearance of anchovy paste and can cause severe right upper quadrant pain.

Trichomonas
Trichomonas on Trike
Metronidazole is used in the treatment of Trichomonas. Trichomonas vaginalis is an anaerobic protozoa that causes trichomoniasis, a sexually transmitted infection of the urogenital tract. Women commonly present with vaginitis with pruritus and burning and have a characteristic foul smelling greenish vaginal discharge. Some women with infection will have a strawberry cervix, which is an erythematous cervix with punctuate areas of exudation caused by capillary dilation from inflammation.

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Gardnerella

Gardner-ella

Metronidazole is used in the treatment of Gardnerella. Gardnerella vaginalis is a pleomorphic bacteria which is the principle organism responsible for the common complaints of bacterial vaginosis. Bacterial vaginosis is characterized by an overgrowth of bacteria within the vaginal canal which results in greyish discharge and fishy odor. The diagnosis is made using KOH prep where the foul smell can be appreciated as a positive whiff test. Additionally under microscopic examination, characteristic epithelial cells covered in bacteria, called clue cells, indicate a positive diagnosis.

Anaerobes

Ant-robe

Anaerobic bacteria do not require oxygen to survive. Metronidazole is commonly used in the treatment of anaerobic infections below the diaphragm while clindamycin is used for anaerobic infections above the diaphragm. An important anaerobic bacteria that Metronidazole is used to treat is Clostridium difficile.

Side Effects

Metallic taste

Metal mouth

A common side effect of metronidazole use is a metallic taste in the mouth.

Disulfiram like Reaction with Alcohol

Dyed-shirt-surfer with Alcohol-bottles

Alcohol consumption while taking metronidazole can cause a disulfiram like reaction that includes symptoms of nausea, vomiting, skin flushing, tachycardia, and shortness of breath. Therefore, alcohol should be avoided by patients for at least 48 hours after completion of treatment.

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