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Toxicity Mechanisms and Immune Reactions in Pharmaceutical Drugs

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Commentary

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DESCRIPTION

Pharmacotoxicology is the study of the impact of toxic exposure to pharmaceutical drugs and agents in the field of health care. Pharmacotoxicology also deals with the treatment and prevention of toxicity caused by medicines. Pharmacodynamics (the effects of a drug on an organism) and pharmacokinetics (the effects of a drug on an organism) are the two categories of Pharmacotoxicology (the effects of the organism on the drug).

Toxicity mechanisms in pharmaceutical drugs

Pharmaceutical medications can cause toxicity through a number of mechanisms. Covalent binding of the drug or its metabolites to specific enzymes or receptors in tissue-specific pathways elicits toxic reactions, which is a highly typical mechanism. Covalent binding can happen on-target or off-target, as well as after biotransformation.

On-target toxicity: Mechanism-based toxicity seems to be another term for on-target toxicity. The interactions of the medicine with its intended target are by far the most typical cause of this type of adverse event from pharmaceutical drug exposure. Both the therapeutic and hazardous targets are the same in this scenario. Many

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times, the drug must be adjusted to target a different element of the sickness or symptoms in order to avoid toxicity throughout treatment. Statins are an example of a medicine class that can have harmful side effects when used to treat a specific condition (HMG CoA reductase).

Immune reactions

Some pharmaceuticals, such as β-lactam antibiotics, can cause allergic responses. Penicillin can cause the production of particular antibodies and trigger an immunological response in some persons. When this response is triggered unnecessarily, it can cause serious health problems and inhibit the immune system from functioning properly. Immune responses to pharmaceutical exposure are typical in cases of unintentional contamination. In gilthead seabream, tamoxifen, a selective estrogen receptor modulator, has been proven to modify the humoral adaptive immune reaction. Pharmaceuticals can cause harm not just to humans, but also to organisms that are unintentionally introduced in this circumstance.

Toxicity off-target: Nonspecific drugs frequently have adverse effects on targets other than those sought for pharmaceutical treatments. Severe downstream effects can occur if a medicine binds to unexpected proteins, receptors, or enzymes that change pathways other than those designed for treatment. The medicine eplerenone (aldosterone receptor antagonist), which is supposed to increase aldosterone levels yet has been proven to cause prostate shrinkage, is an example of this.

Bioactivation: Bioactivation is an essential phase in the activity of several drugs. The parent form of the chemical is frequently not the active form, and it must be processed to produce therapeutic effects. In some instances, bioactivation isn't required for medications to be active; instead, it can generate reactive intermediates that induce greater severe side effects than the drug's original form. Phase-I metabolic enzymes, such as cytochrome P450 and peroxidases, could be used to bioactivate materials. Reactive intermediates can cause enzymatic pathway dysfunction or accelerate the generation of reactive oxygen species, both of which can raise stress and upset homeostasis.

Interactions of drugs: When many medications are taken at the same time, drug interactions can develop. And that can have additive (more than one individual drug) or non-additive (therapeutic effects are less than one individual drug) effects, as well as functional changes (one drug changes how another is absorbed, distributed, and metabolized). Drug-drug interactions can be extremely dangerous for people who are on multiple medications. Chloroquine, an anti-malaria drug, used with statins for cardiovascular disease treatment has been demonstrated to decrease Organic Anion-Transporting Polypeptides (OATPs), resulting in systemic statin exposure.