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Mini Review: Role of Inhibitors in Cancer Therapy

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ABSTRACT

The report presented details on different types of inhibitors and their localized actions on cells. The review presented details from specific studies conducted in cancer clinical care. The work also presented reviews on the use of inhibitor for other clinical treatments and practices.

Keywords: Inhibitors, Enzyme Inhibitors, Autophagy, Apoptosis, Sensitizers

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Introduction

The very role of inhibitors is to control mechanisms in the biological system. Inhibitors like enzyme inhibitors are used for the regulation of metabolic activities where their role is to either slow down or completely block the rate at which a certain biochemical reaction happens[1-13]. There are different forms of inhibitors such as reversible inhibitors and covalent inhibitors etc. Inhibitors act as therapeutic agents in the context of cancer. In the context of cancer, peptides are used to inhibit the production of specific protein enzymes that act as the signaling pathways for cell protein creation and suppression. The drug's inhibition action can help suppress tumors[14-22]. The very cell fate is controlled by these inhibitors as the cell renewal, the survival and reprogramming of cells depend on these. This work aims to present the review of the inhibitors and their action in different treatments.

Inhibitors in Multidrug Nano Delivery

Han et al.[23] assessed cancer treatment therapy by using synergistic multidrug therapy instead of the monotherapy. Co-encapsulation of multiple anticancer agents led to better therapeutic efficacy. The drugs tested were DOX and 5-Fu. The use of combination drugs increased the inhibiting actions. Progression of tumor growth was inhibited by the drug Dox-DNM/5-Fu[24-32]. In vitro toxicity shows that the cellular growth inhibition happened at different levels, once the drug-loaded micelles were injected. IC50 referring to the half-maximal inhibitory concentration was observed to be very low that the inhibition effects were achieved when the drugs were used alone, for example, when free Dox and free 5-Fu was used. Cellular uptake levels were improved by the micelles, but the inhibitory action itself was because of the combination of drugs used. A synergistic anti-tumor effect was noticed when the growth size of the tumor was significantly reduced. The inhibitory action observed here was noted as follows. Firstly, there were high levels of cell apoptosis reported in the tumor when the tumor was hit the combination drugs. The rats with cancer showed high tumor reduction when 5-Fu and Dox DNM were administered. Elevated apoptosis meant tumor cells were dying or shrinking faster[33-37].

Sun et al.[24] analyze how the co-delivery of drugs is useful for handling the issues of drug resistance in chemotherapeutic treatments. MDR causes intolerable toxicity and in some cases even the death of the patient. Combining nanotechnology and co-delivery hence is recommended by the authors as the way to handle MDR. When drugs like Chloroquine CQ are used, the inhibitory action is different than 5-Fu and Dox DNM. Here the inhibitory action is not focused on elevated apoptosis alone, but it is also focused on autophagy. Autophagy is a method of cell regulation[23,38,39]. It is a natural method. In this method, the cell disassembles those components that are no longer necessary or are dysfunctional in nature and then degrades those components. This effect helps in cell renewal and survival. Now the effect of autophagy on tumor cells is that it helps the tumor cells survive. The stress on tumor cells will lead to the cells inducing autophagy by which mechanism of the cells will renew and survive. Now the use of drugs like Chloroquine CQ would

inhibit autophagy without which the tumor cells will not be able to offer resistance to chemotherapy. Combining CQ with other drugs for treatment will have the inhibition effects on autophagy hence deliver better anti-cancer effects.

Suppressing MDR

MDR inhibitors such as efflux pump P-gp are useful for suppressing the multidrug resistance effect. When nanoparticles containing combination drugs are used, then there are issues of high cytotoxicity or there are issues of drug resistance. This is a chain reaction where with drug resistance; drugs would have to be increased, leading to more cytotoxicity and so on. The use of MDR inhibitor drugs breaks this cycle. It not only suppresses MDR but also ensures the levels of cytotoxicity are maintained which will have an effect on the tumor cell. MDR inhibitors and the co-delivery process hence are mutually beneficial when producing treatment outcomes.

Inhibitors are used as sensitizers as well. It is the alteration of the apoptosis pathway that leads to multidrug resistance. The use of inhibitors like pyrrolidinedithiocarbamate PDTC which is an NF-κB inhibitor helps re-sensitize these pathways. Once the pathways are re-sensitized by the actions of the PDTC acting as an inhibitor, the cancer cells are more sensitive to the anti-cancer drugs. The MDR effect goes down as well. The cytotoxicity of the delivered chemotherapeutics is thus balanced and it is possible for the treatment to have an improved response than before the use of the sensitizer. Similarly, Yang et al. in their work identify how inhibition effects of loaded exosomes will induce cell arrest. Cell growth or regulation arrest will lead to cell destruction, which is important for cancer cell growth control. CDK4 protein production was reduced by as much as 60 percent in tumor tissues. Tumor growth tested in-vivo showed the reduction.

Other Clinical Effects

Research works to highlight the use of inhibitors in different treatment requirements. For instance, researcher Li et al[14]. identified that tyrosinase inhibitor actions were helpful for the control of skin pigmentation. The specific activity was on melanin productions. Such work and understanding of inhibitor actions are useful for the treatment of neurodegenerative diseases. Similarly, Chen et al. argue for the efficacy of cholinesterase inhibitors that are part of the therapeutic strategy for Alzheimer's disease (AD).

Conclusion

This report reviewed the different inhibitors and their action on different treatment plans. Much of the work was focused on improving the efficacy of cancer treatment plans. The work discussed inhibitors being analyzed for other issues like the AD and neurodegenerative diseases.

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