OH&RM ONE HEALTH & RISK MANAGEMENT

Supplement, VOL. 2, ISSUE 4
2021

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NANOTECHNOLOGY APPROACHES FOR FUNGAL DISEASES

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Keywords: *antifungal drug, nanotechnology, silver nanoparticles, fungal disease.*

Introduction. Diseases caused by fungi affect millions of people every year worldwide and most of these infections requiring hospitalization and advanced treatment. Therefore, well-timed and appropriate laboratory diagnostic, treatment of invasive fungal infections (IFIs) are major importance in the management of these diseases. The analyzed scientific studies highlighted that despite the drug availability on the market aimed to treat these infections, their efficiency is arguable, while their side effects cannot be significant. As for the drawbacks of the available drugs, these are related to their physical-chemical properties Antifungal medicine is usually of hydrophobic character meaning they have poor solubility in water. Both issues lead to limitations in terms of their efficacy and efficiency within the clinical settings. Therefore, scientific studies on development of new antifungal compounds are urgently required. The purpose of the study was to carry out an analysis of the specialized literature related to nanotechnology approaches for fungal diseases, a new emerging novelty in treatment of IFIs.

Material and methods. The study is based on 45 literature sources written by foreign authors (from USA, Italy, Germany, Canada, Spain, Romania etc.). Most publications come from highly developed countries. The bibliographic search was performed on the evidence-based sources, on the mostly relevant databases – such as PubMed, HINARI, Google Scholar. The filter for the publication date has been set for the last 10 years.

Results. Over the recent decades, a specific scientific interest was given to nanotechnology, which has become an extremely well-known and researched domain. The high incidence of fungal infections has become a worrisome public health issue. The major issue among these is the resistance to antifungals, an increasing hazard for the effective treatment of IFI, which make therapy difficult sometimes even impossible. Late diagnosis and delayed treatment are the top causes for the high morbidity and mortality rates of IFIs. A number of studies reported challenges in using antifungals including but not limited to diminished efficacy of medication, limited drug penetration through tissue, low solubility in water, decreased bioavailability, and poor drug pharmacokinetic properties. Apart from the physical-chemical limitations, the low number of available antifungal agents is also accompanied by their toxicity and high resistance.

Currently, the treatment approach for IFIs is rather limited and includes three main classes of drugs, such as polyenes, azoles, and echinocandins.

Considering that there is a stringent need for alternatives in treatment of invasive fungal infections, it is believed that nanostructured systems are the solution, since they could be excellent carriers for antifungal drugs. Studies that investigated the innovative therapeutic techniques via nanotechnology and medically important fungi have established that there are compelling enhancements in the antifungal properties, such as bioavailability, toxicity, and target tissue for some antifungal drugs.

Conclusions. In conclusion, there is an obvious requirement for new therapeutic alternatives for IFIs due to the low number of drugs and their high resistance to antifungal agents, mainly in medically relevant fungi. The well-timed and adequate pathogen detection is decisive for disease management and prevention of drug resistance, thus aiding in the prevention of therapeutic failures and death in case of invasive fungal infections. There is an urgent need for cutting-edge and cost-effective nanotechnologies providing management of fungal diseases, which are considered challenging issues facing today's health systems.