Combination of Antifungals with Photodynamic Inactivation to Reduce Fungal Resistance

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Fungal infections are increasingly recognized as significant emergent diseases, accounting for approximately 1.7 million fatalities annually. The yeast *Candida albicans* serves as a notable opportunistic pathogen. This organism exhibits dimorphic growth and possesses mechanisms to resist antifungal agents, particularly affecting individuals with compromised immune systems. Antifungal drug resistance encompasses a broad spectrum of phenomena, typically characterized by the ineffectiveness of therapeutic agents, which consequently leads to the continuation or exacerbation of Infections. In response to challenges posed by fungal resistance, antimicrobial photodynamic inactivation [PDI] has emerged as a promising technique for microbial control. Upon light absorption, chemical reactions generate reactive oxygen species, which are deleterious to microbial cells. The aim of this study is to augment the antimicrobial efficacy of antifungals against both sensitive and resistant fungal strains through the mediation of reactive oxygen species. This research assessed the Minimum Inhibitory Concentrations [MIC] of Fluconazole, Amphotericin B, and Itraconazole to determine the resistance and sensitivity profiles of the fungal strains. Additionally, sub-lethal photodynamic inactivation protocols employing curcumin as a photosensitizer were executed. Post-treatment, the rate of growth inhibition was quantified. A defined light dose of 15 J/cm^2 and a curcumin concentration of 2.5 μM were established, with a subsequent incubation period of 20 minutes. Following the application of PDI, the MICs of the antifungals were reassessed to detect any shifts in their efficacy. The results indicated that *C. albicans* exhibited resistance to Fluconazole and Amphotericin B, while remaining sensitive to Itraconazole. Notably, the application of PDI resulted in reduced MIC values, suggesting an enhanced susceptibility of the fungal cells to the antifungal drugs. This enhancement indicates that pre-treatment with PDI may play a crucial role in diminishing microbial resistance. Further investigations are necessary to elucidate the interactions between PDI and antifungal agents and to optimize this approach for clinical applications.