

PORPHYRINS IN PHOTODYNAMIC THERAPY: ANTIMICROBIAL EFFECTIVENESS WITH TOXICOLOGICAL SAFETY?

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INTRODUCTION: Porphyrins are organic molecules with a macrocyclic structure, composed of four pyrrole rings connected by methine bridges. They perform essential biological functions, such as oxygen transport in living organisms. In photodynamic therapy (PDT), these substances can be used as photosensitizers (PS), which, when activated by visible light (400–800 nm) in the presence of molecular oxygen, generate reactive oxygen species (ROS), promoting the oxidation of vital microbial structures, ultimately leading to cell death. **OBJECTIVE:** This study aims to analyze academic publications that investigated the antimicrobial activity of porphyrins, emphasizing the cytotoxicity profile of these compounds. **MATERIALS AND METHODS:** The study was conducted using the PubMed, ScienceDirect, and University of Lisbon Repository databases, between March and April of 2025. The following keywords were used: porphyrins; porphyrins + photodynamic therapy; porphyrins + antimicrobial action; porphyrins + cytotoxicity. **RESULTS AND CONCLUSION:** Based on the analyzed studies, porphyrins demonstrate efficacy against fungi such as *Candida albicans* and bacteria such as *Staphylococcus* spp. when used in PDT. Among the PS studied, cationic porphyrins such as 4MeTPyP have shown an effect in reducing biofilms, even at low compound concentrations and light exposure. Regarding toxicity, the compounds proved to be safe for tested human keratinocytes and fibroblasts, indicating selectivity for microbial cells. Additionally, another study highlighted tetra-cationic porphyrins containing Pt(II) complexes, showing significant antifungal activity and a substantial reduction in fungal biofilm formation. Importantly, this study reported no significant toxicity in human cell lines, reinforcing their potential for safe clinical application. In conclusion, porphyrins emerge as effective and safe photosensitizers in antimicrobial photodynamic therapy, offering a promising alternative in combating resistant microorganisms. However, tailoring treatment protocols and conducting further clinical studies are essential to consolidate their use in medical practice.

KEYWORDS: Porphyrins; Photodynamic therapy; Antimicrobial activity; Cytotoxicity.