

Candida Biofilms and Some Strategies for Prevention

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Biofilm formation by fungal and bacterial pathogens on implanted medical devices causes major morbidity and mortality among patients, and leads to billions of dollars in healthcare cost. There are estimated to be more than 45 million medical devices implanted every year in the United States. Infection of these devices occurs in 60% of patients, and *Candida* species are responsible for up to 20% of these infections [1]. Biofilms are complex structures are highly resistant to antimicrobial agents and the host immune system. These cells biofilm, have an altered phenotype with respect to growth rate and gene transcription [2]. Studies have shown that the microorganisms are almost non-existent in their planktonic free form in the tissues of the host, but are grouped together, forming a multicellular community, both in tissues and on prostheses, catheters and other surfaces [3]. Transplantation procedures, immunosuppression, the use of indwelling devices and prolonged intensive care unit stays have increased the prevalence of fungal disease Availability to the inside of medical devices, such as central and peripheral catheters, haemodialysis and peritoneal dialysis units and intracardiac prosthetic valves, facilitates biofilm formation [4]. Biofilm present in the dental plaque was the first to be recognized by the medical community in the 1960s [5]. The formation and accumulation of biofilm on substrates in the oral cavity is the main etiologic factor of oral diseases, candidiasis is one of the most common fungal oral infections diagnosed in humans, with a prevalence of up to 75% in prosthesis users [6]. Patients who underwent hemodialysis and peritoneal dialysis are commonly affected by infections caused by the presence of biofilm [7]. The *Candida* yeasts are among the main microorganisms isolated from patients with cancer, possibly due to infection with the use of implanted devices for intravenous access. The mechanisms of resistance of the biofilm include extracellular matrix (ECM), efflux pump activity, persisters, cell density, overexpression of drug targets, stress responses, and the general physiology of the cell [8]. Thus, to increase the efficiency of new treatment strategies against bacterial and fungal infections, factors that lead to biofilm growth inhibition, biofilm disruption, or biofilm eradication are being sought. These factors could include enzymes, sodium salts, metal nanoparticles, antibiotics, acids, chitosan derivatives, or plant extracts. Thus, strategies aiming the search for eradicating the biofilms are necessary [9]. More recently, the use of silver nanoparticles (AgNPs) has been suggested for coating medical titanium implants in the hope of inhibiting biofilm formation and thereby reducing the incidence of microbial infections and rejection [10]. Anti-*Candida* antibodies can reduce the binding of *Candida* to various surfaces [11]. Studies with antibodies have been performed by various authors to test their effects on various fungal and bacterial organisms. The application of photodynamic therapy has been investigated regarding its inactivation of micro-organisms that are pathogenic to the human host. Several authors have associated light emitting diodes (LEDs) with other substances [12]. More studies have been performed with gold nanoparticle and enhanced photodynamic therapy including the use of methylene blue against recalcitrant pathogenic *C. albicans* biofilms [13]. Also, because the biofilm matrix is composed of DNA, proteins, and extracellular polysaccharides, recent studies have indicated that the disruption of the biofilm structure could be achieved via degradation of individual biofilm compounds by several enzymes such as DNase, lactonases, α -amylases [9].

The development of strategies to combat microorganism growing in biofilms is yet a challenging task these bacterial and fungal are much more resistant to classical antimicrobial therapies. Although there are several studies to seek the destruction and removal of biofilms, many studies will be necessary and the way is hard.

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