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Editorial

Biofilms And Antibiotic Resistance

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Nature microorganisms, 1% in planktonic-free-floating cells and 99% in the form of a colony in micro-ecosystem called biofilm at various stages of growth. The microorganism colony in biofilms can be one species or multiple species and the films can be one layer or multiple layers. The primary matrix material is an extracellular polymeric substance (EPS) composed mainly of polysaccharides. Biofilms are found in the biotic surface (examples: skin, respiratory tract mucosa, intestine mucosa, urinary tract mucosa) and abiotic surface, i.e.: medical devices (peripheral venous catheter, urinary catheter, nasogastric tube, contact lens, protease) and other abiotic surfaces.[1-4]

Biofilm formation on the tissue and abiotic surfaces adversely affects one's health, because biofilm-colonizing microorganisms cause antibiotic resistant microorganisms and the resistance up to 1,000 times can tolerate the body's immune system and external stressors. Because of that, biofilm contributes to 80% of chronic persistent infection and recurrency, 65% of nosocomial infection.[5-8] Biofilm should be included in the bloodstream and urinary tract infection, and bloodstream infection virulence factor.[8] Microorganism resistance mechanisms to the antibiotic caused by these factors include (1) EPS factor, (2) gene expression variety because the mutation occurs in stressful environments, and (3) high bacteria density and variety of bacteria colonies.[6] Parsek and Singh provide useful criteria to define biofilm infection. The criteria include: "(a) The infecting bacteria are adherent to some substratum or are surface-associated. (b) Direct examination of infected tissue shows bacteria living in cell clusters, or microcolonies, encased in an extracellular matrix. The matrix may often be composed of bacterial and host components. (c) The infection is generally confined to a particular location. Although dissemination may occur, it is a secondary phenomenon. (d) The infection is difficult or impossible to eradicate with antibiotics even though the responsible organisms are susceptible to killing in the planktonic state."[6]

Natural microorganisms in 40-80% could form a biofilm, and associate with infection in many parts of body system organs, including ear, cardiovascular, digestive, integument, reproductive, respiration, and urinary. Biofilm infection in many body organ systems is associated with the phases life cycle of biofilm including (1) Attachment, (2) Colonization, (3) Proliferation (4) Maturation, and (5) Dispersion. Bacteria colonize and attach to the tissue surface and embedding in a matrix, gain the ability to evade the host immune system. Dormant situation evades the immune system, causing local tissue damage and acute infection. Bacteria in biofilm adapt to an anoxia environment and minimal nutrition through metabolic, gene expression, and protein production changes, ultimately causing low metabolic rate and decrease cell division. These adaptations make bacteria more resistant to antibiotic therapy through the inactivation of antibiotic targets and decrease cellular function demands thereby reducing and inactivating antibiotics target interventions. During biofilm infection, simultaneous activation of the innate and adaptive immune system occurs, but could not eliminate pathogen biofilm, instead, it accelerates damage to surrounding tissue. According to these, biofilm infection diseases are persistent and slow-growing infections, and the immune system rarely resolves the infection and inconsistence to antibiotic therapy. [9,10]

Biofilm formation is initiated with adhesion on the tissue surface. Four factors that influence the adhesion process, include (1) time duration of exposure on the surface (2) inoculated bacterial population (3) bacterial characteristics (for example cell wall components, appendages, and motility) (4) surface type and nutrition. The adhesion ability of attached motile bacteria is mediated by a chemotaxis transducer and a flagellum, a surface appendage that confers bacteria active locomotion. The attached motile bacterium on the surface will enhance the

formation of biofilm. The choices of the agent substrates for biofilm controlling formation and infection should be by the majority of the bacterial target point.[11] Swarming motility is regulated by quorum-sensing and giving the biofilm ability on the surface.[12] Many compounds could disturb quorum-sensing signal cascades, such as halogenated furanone isolated from *Delisea pulchra* (marine algae), acyclic diamine (ADM 2), ginseng extract, garlic extract, usnic acid, and azithromycin.[5] Berkala Ilmiah Kedokteran Duta Wacana 6.2 edition published the research of the inhibition activity of *Anredera cordifolia* leaves to swimming motility of *Escherichia coli* isolated from urinary tract infection patients. *Anredera cordifolia* leaves extract on 1750 µg per ml concentration, significantly inhibits swimming motility of *Escherichia coli* compared to the negative control. According to literature, *Anredera cordifolia* leave extract could inhibit bacterial cell wall synthesis, cell membrane function, protein synthesis, and bacterial cell growth.

The physician and health practitioner's attention and alertness to biofilm existence and the consequences of biofilm in the biotic and abiotic environment are important to improve hygiene practice, rational antibiotic prescription, controlling the spread and emergence of emergency antibiotic resistance in healthcare facilities and community. The majority of chronic persistence and recurrent infection because of antibiotic resistance is biofilm infection, so there is a need for a precise and effective alternative approach to management and therapy.

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