OPEN ACCESS Freely available online

Mycobacterial Diseases

ISSN: 2161-1068

Commentary

The Resilience of *Mycobacterium* Biofilms

Bo Jae Kang*

Department of Immunology, Gunma University, Maebashi, Gunma, Japan

DESCRIPTION

Mycobacterium species, including the notorious *Mycobacterium tuberculosis* (Mtb) and *Mycobacterium Avium* Complex (MAC), are capable of forming biofilms. Biofilms are structured communities of bacteria encased in a self-produced matrix that adheres to surfaces. These biofilms provide a protective niche for bacteria, making them more resistant to environmental stresses, antibiotics, and the host immune system. Understanding the formation, characteristics, and implications of *Mycobacterium* biofilms is essential for developing effective treatment strategies against mycobacterial infections.

Formation of *mycobacterium* biofilms

Mycobacteria adhere to a surface using pili, adhesins, and other surface proteins. Hydrophobic interactions between the bacterial cell wall and the surface also play a important role in initial attachment. After initial attachment, the bacteria begin to multiply and form microcolonies. During this phase, the cells start to produce Extracellular Polymeric Substances (EPS), which are important for biofilm development. The microcolonies grow and merge, leading to the maturation of the biofilm. The EPS matrix, composed of polysaccharides, proteins, and lipids, encases the bacterial cells. This matrix protects the bacteria from external threats and provides structural stability. Portions of the biofilm can detach and disperse, allowing the bacteria to colonize new surfaces and spread the infection. *Mycobacterium* biofilms exhibit a high level of resistance to antibiotics. The EPS matrix acts as a barrier, preventing the penetration of antibiotics. Additionally, bacteria within biofilms often exhibit a slower growth rate and enter a dormant state, reducing the effectiveness of antibiotics that target actively growing cells. The biofilm matrix shields the bacteria from immune system attacks. Immune cells, such as macrophages and neutrophils, find it difficult to penetrate the biofilm and eliminate the bacteria. Within a biofilm, bacteria can exhibit metabolic diversity. Some cells remain metabolically active, while others enter a dormant state. This heterogeneity contributes to the resilience and persistence of the biofilm.

Implications of *mycobacterium* biofilms

Biofilm formation is associated with chronic and persistent infections. In diseases such as Tuberculosis (TB) and Nontuberculous Mycobacterial (NTM) infections, biofilms contribute to the difficulty in eradicating the bacteria and the long duration of treatment required. Mycobacterium biofilms can form on medical devices, such as catheters, prosthetic joints, and implants. These biofilms can lead to device-related infections that are challenging to treat and often require device removal. *Mycobacterium* species can form biofilms in natural and artificial environments, including water distribution systems and soil. This environmental persistence poses a risk for transmission and infection.

Research is ongoing to develop agents that can disrupt biofilm formation or enhance the penetration of antibiotics into biofilms. These agents may target the EPS matrix, quorum sensing (the communication system among bacteria), or specific biofilm-associated proteins. Combining antibiotics with biofilm-disrupting agents or using multiple antibiotics with different mechanisms of action can enhance treatment efficacy against biofilm-associated infections. Innovative drug delivery systems, such as nanoparticles and liposomes, are being explored to improve the delivery of antibiotics to biofilms and enhance their antimicrobial activity. Preventing biofilm formation on medical devices through surface modifications, coatings, or antimicrobial agents can reduce the risk of device-related infections.

CONCLUSION

Mycobacterium biofilms represent a significant challenge in the treatment and management of mycobacterial infections. Their resistance to antibiotics and protection from the immune system contribute to chronic and persistent infections. Understanding the mechanisms of biofilm formation and developing strategies to disrupt or prevent biofilms are important for improving treatment outcomes and reducing the burden of mycobacterial diseases. Continued research and innovation are essential to combat the resilience of *Mycobacterium* biofilms and enhance our ability to treat these complex infections effectively.

Correspondence to: Bo Jae Kang, Department of Immunology, Gunma University, Maebashi, Gunma, Japan, Email: bojakang@uhs.ac

Received: 06-May-2024, Manuscript No. MDTL-24-32857; **Editor assigned:** 08-May-2024, PreQC No. MDTL-24-32857 (PQ); **Reviewed:** 22-May-2024, QC No. MDTL-24-32857; **Revised:** 29-May-2024, Manuscript No. MDTL-24-32857 (R); **Published:** 05-Jun-2024, DOI: 10.35248/2161-1068.24.14.466.

Citation: Kang BJ (2024) The Resilience of Mycobacterium Biofilms. Mycobact Dis. 14:466.

Copyright: © 2024 Kang BJ. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.