Treat Respir Med. 2005;4(4):241-53.

Airway biofilms: implications for pathogenesis and therapy of respiratory tract infections.

Kobayashi H[1].

Author information

1 First Department of Internal Medicine, Kyorin University School of Medicine, Shinkawa, Mitaka, Tokyo, Japan. hkobaya@kyorin-u.ac.jp

Abstract

The differentiation of bacterial biofilms in the airway environment, the pathogenesis of airway biofilm, and possible therapeutic methods are discussed. Biofilm diseases that characteristically involve the respiratory system include cystic fibrosis (CF), diffuse panbronchiolitis (DPB), and bronchiectasia with Pseudomonas aeruginosa (P. aeruginosa) infection. There is evidence to suggest that almost all strains of P. aeruginosa have the genetic capacity to synthesize alginate, a main matrix of biofilms, when ecological conditions are unfavorable for their survival. The bacteria inside the mature biofilm show increased resistance to both antibacterials and phagocytic cells, express fewer virulence factors because of their stationary state of growth, and are less stimulatory to the mucosa because of the 'sandwich binding'. These factors facilitate both the colonization of bacteria and their extended survival even under unfavorable conditions. Since the biofilm limits colonization to a latent form, the clinical symptoms in this situation are unremarkable. However, the clinical progression of both CF and DPB proceeds in two characteristic directions. The first is an acute exacerbation caused by planktonic bacteria that have germinated from the biofilm. The second is a slow progression of disease that is induced by harmful immune reactions. The harmful reactions are mediated by alginate, which induces antigen antibody reactions around the airways, as well as formation of circulating immune complexes that are deposited on lung tissue. Furthermore, the highest titer of bacterial permeability increasing anti-neutrophil cytoplasmic autoantibodies (BPI-ANCA) is observed in association with highly impaired pulmonary function in patients with CF and DPB, as well as in patients with a lengthy period of colonization with P. aeruginosa. BPI-ANCA subsequently makes chronic airway infection even more intractable. The long-term use of 14- or 15-ring membered macrolides results in a favorable clinical outcome for patients with DPB and in some patients with CF. In the last 10 years, an increasing number of studies have reported secondary actions of macrolides that include effects on both airway and phagocytic cells, as well as an anti-biofilm activity. The 14- or 15-ring membered macrolides inhibit: (i) the alginate production from P. aeruginosa; (ii) the antibody reaction to alginate, which leads to a decrease in the immune complex formation; and (iii) the activation of the autoinducer

3-O-C12-homoserine lactone and subsequent expression of lasI and rhlI in quorum sensing systems in P. aeruginosa. These anti-biofilm actions of macrolides may represent their basic mechanisms of action on airway biofilm disease.

PMID: 16086598

[Indexed for MEDLINE]

Publication type, MeSH terms, Substances

LinkOut - more resources

Turn Off Clear

Airway biofilms: implications for pathogenesis and PubMed

Bacterial biofilms: a common cause of pe PubMed

Biofilm streamers cause catastrophic disruption of

Biofilm streamers cause catastrophic disruptio PubMed

Spatial structure, cooperation and com PubMed

See more...

You are here: NCBI > Literature > PubMed

Support Center

GETTING STARTED
NCBI Education
NCBI Help Manual
NCBI Handbook
Training & Tutorials
Submit Data

RESOURCES
Chemicals & Bioassays
Data & Software
DNA & RNA
Domains & Structures
Genes & Expression
Genetics & Medicine
Genomes & Maps
Homology
Literature
Proteins
Sequence Analysis
Taxonomy
Variation

POPULAR
PubMed
Bookshelf
PubMed Central
BLAST
Nucleotide
Genome
SNP
Gene
Protein
PubChem

FEATURED
Genetic Testing Registry
GenBank
Reference Sequences
Gene Expression Omnibus
Genome Data Viewer
Human Genome
Mouse Genome
Influenza Virus
Primer-BLAST
Sequence Read Archive

NCBI INFORMATION
About NCBI
Research at NCBI
NCBI News & Blog
NCBI FTP Site
NCBI on Facebook
NCBI on Twitter
NCBI on YouTube
Privacy Policy

National Center for Biotechnology Information, U.S. National Library of Medicine
8600 Rockville Pike, Bethesda MD, 20894 USA

Policies and Guidelines | Contact