Journal of Infection and Public Health (2017) 10, 369—378

http://www.elsevier.com/locate/jiph

REVIEW

Antibiotic resistance

Marianne Frieri[a,*], **Krishan Kumar**[b,1], **Anthony Boutin**[c,1]

[a] *Division of Allergy Immunology, Department of Medicine, Nassau University Medical Center, 2201 Hempstead Turnpike, East Meadow, NY 11554, United States*
[b] *Division of Pediatric, Department of Emergency Medicine, Nassau University Medical Center, 2201 Hempstead Turnpike, East Meadow, NY 11554, United States*
[c] *Adult Emergency Medicine, Department of Emergency Medicine, Nassau University Medical Center, 2201 Hempstead Turnpike, East Meadow, NY 11554, United States*

Received 21 May 2016; accepted 4 August 2016

KEYWORDS
Antibiotic resistance;
Biofilms;
Infections;
Public health;
Emergency Department

Summary Antimicrobial resistance in bacterial pathogens is a challenge that is associated with high morbidity and mortality. Multidrug resistance patterns in Gram-positive and -negative bacteria are difficult to treat and may even be untreatable with conventional antibiotics. There is currently a shortage of effective therapies, lack of successful prevention measures, and only a few new antibiotics, which require development of novel treatment options and alternative antimicrobial therapies. Biofilms are involved in multidrug resistance and can present challenges for infection control. Virulence, *Staphylococcus aureus*, Clostridium difficile infection, vancomycin-resistant enterococci, and control in the Emergency Department are also discussed.

Contents

* Corresponding author at: Nassau University Medical Center, Department of Medicine, 2201 Hempstead Turnpike, East Meadow, NY 11554, United States. Fax: +1 516 572 5609.
E-mail addresses: mfrieri@numc.edu (M. Frieri), kkumar@numc.edu (K. Kumar), aboutin@numc.edu (A. Boutin).
[1] Fax: +1 516 572 5465.

http://dx.doi.org/10.1016/j.jiph.2016.08.007
1876-0341/

Introduction

Antibiotic resistance

This study discusses the impact of antibiotic resistance as a persistent, global health threat and highlights efforts to improve this complex problem [1]. Political agendas, legislation, development of therapies and educational initiatives are essential to mitigate the increasing rate of antibiotic resistance. Prescribers, policymakers and researchers are charged with the complex task of mitigating antibiotic resistance in an era when new treatments for bacterial infections are limited. The authors propose that monitoring, surveillance of practice, policy and new treatments provide solutions to antibiotic resistance in both the human and agricultural sectors. This article emphasizes the complexity of antibiotic resistance and highlights the need for a multifaceted approach to improve health care outcomes [1].

Antimicrobial resistance in bacterial pathogens is a worldwide challenge associated with high morbidity and mortality [2]. Multidrug resistant patterns in Gram-positive and -negative bacteria have resulted in difficult-to-treat or even untreatable infections with conventional antimicrobials. Because the early identification of causative microorganisms and their antimicrobial susceptibility patterns in patients with bacteremia and other serious infections is lacking in many healthcare settings, broad spectrum antibiotics are liberally and mostly unnecessarily used [2]. Dramatic increases in emerging resistance occurs and, when coupled with poor infection control practices, resistant bacteria can easily be disseminated to the other patients and the environment [2]. Availability of updated epidemiological data on antimicrobial resistance in frequently encountered bacterial pathogens will be useful not only for deciding on treatment strategies but also for devising an effective antimicrobial stewardship program in hospitals [2].

Resistance of important bacterial pathogens to common antimicrobial therapies and emergence of multidrug-resistant bacteria are increasing at an alarming rate. There are challenges in the combat of bacterial infections and accompanied diseases and the current shortage of effective drugs, lack of successful prevention measures and only a few new antibiotics in the clinical pipeline will require the development of novel treatment options and alternative antimicrobial therapies [3]. The authors stated that increasing understanding of bacterial virulence strategies and induced molecular pathways of the infectious disease provides novel opportunities to target and interfere with crucial pathogenicity factors or virulence-associated traits of the bacteria while bypassing the evolutionary pressure on the bacterium to develop resistance [3]. The authors took a closer look at the bacterial virulence-related factors and processes that present promising targets for anti-virulence therapies, recently discovered inhibitory substances, their promises and discussed the challenges and problems that need to be faced [3].

Finding strategies against the development of antibiotic resistance is a major global challenge for the life sciences community and for public health. The past decades have seen a dramatic worldwide increase in human-pathogenic bacteria that are resistant to one or multiple antibiotics [4]. More infections caused by resistant microorganisms fail to respond to conventional treatment, and even last-resort antibiotics have lost their power. In addition, industry pipelines for the development of novel antibiotics have run dry over the past few decades. A recent World Health Day by the WHO with the theme ''Combat drug resistance: no action today means no cure tomorrow'' triggered an increase in research activity, and several promising strategies have been developed to restore treatment options against infections by resistant bacterial pathogens [4].

The emergence and spread of antibiotic resistance among pathogenic bacteria has been a growing problem for public health in recent decades. It is becoming increasingly recognized that not only antibiotic resistance genes (ARGs) encountered in clinical pathogens are of relevance, but rather, all pathogenic, commensal as