Editorial

Pseudomonas aeruginosa and Its Resistance

Thana Khawcharoenporn*

When asking healthcare professionals to name a bacterial pathogen commonly causing nosocomial infections, *Pseudomonas aeruginosa* always comes up in their mind. This Gram-negative nonfermenting bacterium can be found in the environment, especially in water. In healthcare settings, it is often recovered from the water supply and sinks, and can contaminate surfaces and several types of equipment, which serve as reservoirs for subsequent colonization and infection among hospitalized patients. *Pseudomonas aeruginosa* is also considered an opportunistic pathogen since it usually causes infections among patients with physical, phagocytic, or immunologic defects in host defense mechanisms, such as patients with major burns, neutropenia, cystic fibrosis and those receiving immunosuppressive drugs, especially corticosteroids.

Antibiotic classes that are generally used to treat *P. aeruginosa* associated infections include anti-pseudomonal penicillins, anti-pseudomonal cephalosporins, anti-pseudomonal β-lactam-β-lactamase inhibitors, group 2 carbapenems, aminoglycosides, fluoroquinolones, monobactam, phosphonic acid and polymyxins. Increasingly, there have been reports of infections due to multidrug-resistant *P. aeruginosa* during the past decade.[1] Several of the well characterized molecular mechanisms enable *P. aeruginosa* to survive various hostile conditions during pathogenesis and antibiotic treatment. This bacterium can use all of the 4 main mechanisms to develop resistance to antibiotics, including producing enzymes to destroy antibiotics, altering antibiotic targeted binding sites, pumping antibiotics out via efflux pumps, and changing porins or membrane permeability to prevent entry of antibiotics.[2] The most worrisome strains of *P. aeruginosa* are extensively drug-resistant strains which become resistant to a carbapenem, one of the most broad-spectrum antibiotics, fluoroquinolones, third and fourth generation cephalosporins, and aminoglycosides.

The incidence of carbapenem-resistant *P. aeruginosa* (CRP) in Asian countries has been generally higher than the reported incidence in Europe and North America, while risk factors associated with CRP include: prolonged hospital stay, the presence of invasive devices, prior colonization or infection with *P. aeruginosa*, the presence of CRP in other patients on the same unit with failing infection control measures and prior use of group 2 carbapenems, piperacillin-tazobactam, vancomycin and fluoroquinolones.[3] Mechanisms involving acquisition of metallo-β-lactamases, AmpC-related cephalosporinases, Extended spectrum β-lactamases, expressing efflux pumps and changes in membrane permeability, enable the organism to become resistant to carbapenems.[2, 4] Carbapenem resistance has limited treatment options for *P. aeruginosa* infections and has necessitated the use of older drugs with toxicities, like colistin in resource-limited settings.[5]

To control the spread of *P. aeruginosa* in healthcare facilities, effective treatment along with decontamination of healthcare surfaces,

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Infectious Diseases Unit, Department of Internal Medicine, Faculty of Medicine, Thammasat University, Pathum Thani, Thailand
***Corresponding author:** Thana Khawcharoenporn, MD, MSc, Infectious Diseases Unit, Department of Internal Medicine, Faculty of Medicine, Thammasat University, Pathum Thani, Thailand, Tel. +668 1836 5576, Email: kthana@tu.ac.th

material and equipment is required. Chemical disinfectants, which have activity against *P. aeruginosa*, recommended to be used for decontamination and cleaning processes include: ethanol, hypochlorites, hydrogen peroxide, peracetic acid, phenolics, and quaternary ammonium compounds.[6] Nonetheless, debates have been ongoing in regards to the impact of some disinfectants on promoting antibiotic resistance among bacterial pathogens.[7, 8] In this issue of Asian Medical Journal and Alternative Medicine, Phutthilertmethawee et al. demonstrated that exposure to subinhibitory concentrations of benzalkonium chloride and chlorhexidine did not significantly alter the overall antibiotic susceptibility profile of the tested *P. aeruginosa* strains. The study findings add to the current body of scientific evidence on this topic and emphasize the need for monitoring disinfectant use, while taking risks and benefits into consideration.

In this era of antibiotic resistance, we are inevitably fighting with evolving pathogens. Further research is much needed: in more diverse settings, with larger sample sizes, and coverage in all relevant aspects of treatment and prevention. Such research will enable us to better understand the pathogens, and lead to more efficient and safer ways to control them.

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