What can we learn from the dissemination of carbapenem-resistant Acinetobacter baumannii in patients with burn injury?

In this issue of the Journal of the Chinese Medical Association, Shoja et al characterize the antimicrobial susceptibility pattern, mechanisms, and typing of carbapenem-resistant Acinetobacter baumannii (CRAB) isolates obtained from burn patients from a single center in Iran. They found that the rate of CRAB was high (92.5%) among burn patients. The most effective drugs with in vitro activity against A. baumannii isolates in this study were colistin, polymyxin B, and ampicillin—sulbactam. Carbapenem resistance involved blaOXA-23-like and blaOXA-24-like genes. The clonal spreading of A. baumannii strains were identified among these burn patients. This study suggests the necessity of effective control measures against these multidrug-resistant pathogens.

A. baumannii is an important pathogen causing various nosocomial infections, and has become one of the most commonly isolated pathogens in burn patients. Outbreaks and rapid dissemination of CRAB strains despite prevention and control measures have been reported worldwide, which most commonly occur in intensive care units. The spreading of multidrug-resistant A. baumannii (MDRAB), especially CRAB, has become a threat to public health. The most important mechanism of carbapenem resistance in A. baumannii is the production of carbapenem-hydrolyzing β-lactamases, especially Ambler classes D-carbapenemase (OXA-24-like genes). Most of the groups of OXA-type β-lactamases have been identified on plasmids, and have a high capacity to spread. The insertion sequence ISAbal has been found upstream of blaOXA-23-like and blaOXA-51-like genes in A. baumannii and leads to overexpression of blaOXA genes. Other less-studied mechanisms in carbapenem resistance in A. baumannii are reduced outer membrane permeability, penicillin-binding protein alterations, and overexpression of the efflux pump. BlaOXA-23-like and blaOXA-24-like genes were found among the A. baumannii isolates. Although several mechanisms would work in concert to produce the resistance phenotype, a more detailed investigation of mechanisms for carbapenem resistance is recommended for future study.

Molecular typing of the relevant A. baumannii isolates was a common approach for hospital outbreak investigations. The current study showed that Clones B and C were predominantly determined by repetitive sequence-based polymerase chain reaction, suggesting that these clones were possibly interwary spread resulting in the infection of burn patients. Pulsed-field gel electrophoresis or multilocus variable number of tandem repeats analysis were other common methods for bacterial strain typing. Multilocus sequence typing is also an effective method for comparing epidemiological investigations across different geographical areas, and the Clonal Complexes 92 were prevalent among the CRAB from burn units in several countries. Shoja et al did not provide sequencing type information in the current study. It is better to monitor the clonal complexes of CRAB strains in the burn units, given that the strains with new clonal complexes would result in future outbreaks. It is crucial to establish the strategy of better control of nosocomial CRAB infections and surveillance of this strain using molecular typing in the burn unit.

Kanamori et al recently conducted a molecular investigation of three sequential outbreaks caused by MDRAB at a large academic burn center in the United States using next-generation sequencing. Next-generation sequencing is a promising molecular epidemiology method in investigations of outbreak analysis. A comparative analysis of single-nucleotide variants in bacterial genomes helps us determine the relatedness among epidemiologically linked strains, build a transmission network, and track bacterial strains of interest. They found that the distribution of resistance genes varied among the three outbreaks, and demonstrated the superior resolution of outbreak transmission networks for MDRAB determined by next-generation sequencing. Additional studies using whole genome sequencing of A. baumannii can help us design and implement more efficient interventions to control the dissemination of MDRAB in burn units.

Polymycin B and colistin have good in vitro activity against the CRAB in this study, which is consistent with the literature. However, colistin-resistant CRAB has recently emerged as a new challenge for treatment and infection control. Targeted surveillance and molecular epidemiology for this superbug plus rational use of colistin is suggested to manage this problem. However, the association between antibiotics exposure and the acquisition of MDRAB or CRAB has rarely been described in the burn unit. A dust explosion
occurred on June 27, 2015 in Taiwan and more than 400 healthy young people were injured by the accident. Shie et al. conducted a study at Chang Gung Memorial Hospital, a medical center in Northern Taiwan, to investigate the association of carbapenem exposure with the occurrence of MDRAB in burn patients from this dust explosion. MDRAB isolates were identified in nine of 42 patients (21%). Both the acquisition and disappearance of MDRAB were closely related to carbapenem exposure in these critically ill patients. This investigation indicated that early-discontinued use of carbapenem could be an essential practice for control of MDRAB. The findings from a homogeneous group of critically ill patients with burn injuries provide insight about the role and importance of antimicrobial stewardship to control MDRAB in burn units, which is less frequently addressed in the literature. MDRAB or CRAB was also the predominant pathogen isolated from burn patients in other medical centers in Northern Taiwan (data not shown). More informative data regarding infection control or treatment for this multidrug-resistant pathogen from other burn units in Taiwan would be expected in the future.

Conflicts of interest

The author declares that he has no conflicts of interest related to the subject matter or materials discussed in this article.

References


Yi-Tsung Lin*
Division of Infectious Diseases, Department of Medicine, Taipei Veterans General Hospital, Taipei, Taiwan, ROC
Institute of Emergency and Critical Care Medicine, National Yang-Ming University, Taipei, Taiwan, ROC
*Corresponding author. Dr. Yi-Tsung Lin, Division of Infectious Diseases, Department of Medicine, Taipei Veterans General Hospital, 201, Section 2, Shi-Pai Road, Taipei 112, Taiwan, ROC.

E-mail address: ytlin8@vghtpe.gov.tw (Y.-T. Lin).