Novel Bacteriophage Lysin: A Solution for Antibiotic Resistant Staphylococcus aureus Infection in Vietnam

Le, Tuyet Quynh Anh (School: Tran Phu Gifted High School)
Pham, Thi Minh Hue (School: Tran Phu Gifted High School)

Staphylococcus aureus is a leading cause of bacteremia and endocarditis with high mortality rate. Recent studies demonstrated that S. aureus quickly responds to each new antibiotic, even to virtually all antibiotics, making treatment of these infections more difficult. Lysins, enzymes produced by bacteriophage, can hydrolyze bacterial cell wall thus kill the bacterium. Therefore, researches on the S. aureus phages isolated in Vietnam and their lysins may provide a new solution for antibiotics resistant S. aureus infections in Vietnam. 13 phages were isolated and identified from 197 collected samples based on clarity of their formed plaques and morphologies. To optimize the experiments, we changed some steps or buffer components. An isolated phage with broad host range was further characterized by genome sequencing. A putative phage lysin gene was cloned and expressed in Escherichia coli. Then, the recombinant lysin (rLys) was purified and tested the antimicrobial activity. The result showed that rLys could kill all of the tested clinical antibiotics resistant S. aureus in Vietnam with similar efficacy compared to its parental phage while the known lysinK couldn't. Notably, when analyzed its amino acid sequence, lysin has 7 different amino acids compared to lysinK, in which 4 amino acids in CHAP domain and 3 amino acids in Amidase-2 domain. The effects of mutations on 3D structure of the enzyme was also analyzed by UCSF Chimera program. Consequently, phage lysin isolated in Vietnam could be a novel one and the difference in 7 amino acids may change its global structure which leads to the difference in its bactericidal activity. In conclusion, new lysin could be used as an alternative therapy for treatment of antibiotics resistant S. aureus infections in Vietnam.

Awards Won:
Third Award of $1,000